REPORT RESUMES

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PLUMBING FIXTURES FOR EDUCATIONAL FACILITIES.
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A STUDY OF PLUMBING FIXTURES FOR USE IN EDUCATIONAL FACILITIES WAS MADE TO PROVIDE MANUFACTURERS, ARCHITECTS, AND EDUCATORS WITH A GUIDE TO THE NECESSARY SANITARY FACILITIES REQUIRED FOR--(1) MAINTENANCE OF HEALTH STANDARDS, (2) IMPROVED SUPERVISION, (3) REDUCED MAINTENANCE, AND (4) ENRICHMENT OF THE EDUCATIONAL PROGRAM. THE STUDY IS PRESENTED IN THREE SECTIONS--(1) A DISCUSSION OF EDUCATIONAL PROGRAMS, FACILITIES, AND PLUMBING REQUIREMENTS FOR FIVE GRADE GROUPS FROM KINDERGARTEN THROUGH HIGH SCHOOL, (2) A DISCUSSION OF DATA OBTAINED IN A SURVEY OF 10,000 TEACHERS, PRINCIPALS, AND MAINTENANCE PEOPLE IN 33 CITIES, AND (3) RECOMMENDATIONS FOR SELECTION, INSTALLATION, AND MAINTENANCE OF PLUMBING FIXTURES IN EDUCATIONAL FACILITIES. A BIBLIOGRAPHY OF RELEVANT LITERATURE IS PROVIDED. (JT)

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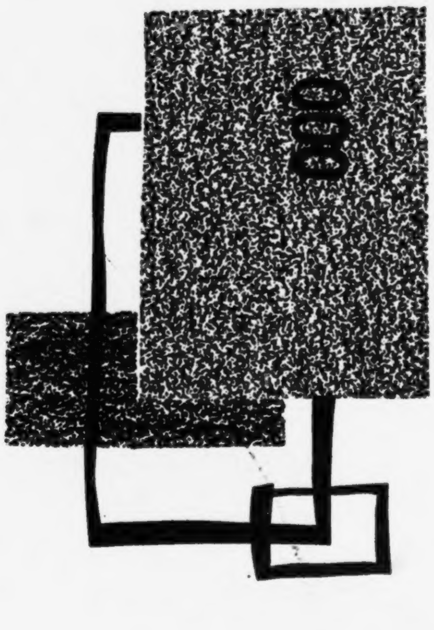
SCHOOL PLANNING LABORATORY

Plumbing Fixtures for Educational Facilities



SCHOOL OF EDUCATION
STANFORD UNIVERSITY
STANFORD, CALIFORNIA

PLUMBING FIXTURES FOR EDUCATIONAL FACILITIES

Plumbing Fixtures for Educational Facilities

Prepared for the
PLUMBING FIXTURE MANUFACTURERS ASSOCIATION

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1959

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FOREWORD

The publication of this study, *Plumbing Fixtures for Educational Facilities*, is a noteworthy milestone in the history of relations between industry and education. "Career days" and "open houses" have typically marked the relationship between the nation's schools and the commercial and manufacturing organizations within the United States. Ordinarily, for only a single day each year, industry and education join hands to link the needs of children and youth to the needs and experience of industry.

This investigation, entered into jointly by the Plumbing Fixture Manufacturers Association and the School Planning Laboratory, Stanford University, considers educational program and school plant facilities, specifically in the relation of educational program to plumbing fixture needs. This report, condensing a significant body of data, is intended to provide manufacturers, architects, and educators in all levels of our educational system with a guide to the necessary sanitary facilities to maintain adequate health standards, to enrich educational program, to provide for improved supervision and convenience, and to reduce maintenance throughout the entire year.

The contributors to this study are not to be found solely among the members of the Association and related industries or within the School Planning Laboratory. Recommendations and suggestions were received from over 10,000 teachers and hundreds of architects, school building principals and superintendents, planning commissions, and custodians. Consultants were brought in from outside agencies. In particular, extensive contributions to this report were made by Dr. Henry Magnuson, Chief, Bureau of Educational Research, California State Department of Education, and Oliver E. Byrd, Ed.D., M.D., Professor of Health Education at Stanford University. The former aided in the over-all research design and tabulation while the latter was consulted on all phases of the report regarding the health aspects of the various plumbing fixture installations within the school plant. Mr. Charles Cox aided in the design and tabulation of the questionnaires used.

Throughout the past year, outstanding assistance was received from the Sub-Committee on Recommended Plumbing Practices of the Plumbing Fixture Manufacturers Association: R. S. Wylie, Chairman, and Ray A. Pape and Stanley S. Backner.

Among the members in the School Planning Laboratory who were assigned to work on the project, particular commendation should be given to Dr. Raymond C. Schneider, Dr. O. Kenneth O'Fallon, Dr. Walter Garcia, Dr. Wm. H. Strand, Clyde T. Gilley, Don Keller, Sam Buchanan, Wade R. Squire, Arthur Newcomb, R. Dudley Boyce, and Stacy Hertsche.

SPONSORS

The sponsors of the study, both members of the Plumbing Fixture Manufacturers Association as well as members of related industries who have joined forces to make this study possible, are listed below:

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INTRODUCTION

There is an increasing awareness that the educational program determines the kind of school building which a community needs and should supply. A good school building starts with sound educational planning as a forerunner to architectural planning. The kinds and sizes of rooms and their relationship to each other are determined first from the standpoint of educational utility. The same is true of lighting, classroom furniture, heating and ventilation, and plumbing. When educational planning is done as the first step in building construction, school buildings provide the kinds of spaces and facilities required for the different teaching-learning experiences which are essential to the modern educational program.

Today there is considerably more emphasis on the youngster as an individual—accepting him for what he is and valuing him for what he may become. There is concern not only for the intellect of children, but with their physical, emotional, social and spiritual growth as well. Experience patterns have been formulated to enable teachers to make a maximum contribution to each child's total development.

Programs of instruction vary widely from community to community, but there are broad common requirements based on cultural, social, and psychological constants. Effective curriculum planning must recognize these constants, but still be flexible enough to be in harmony with local needs and conditions.

Teaching methods have also changed as the findings of research have given a better understanding of how children learn. From a rigid assign-study-recite pattern, the methodology has changed to active planning by pupils, group work on projects, individual research—a more active participation in the learning process.

Both the changes in the curriculum and in methods of instruction have demanded a different kind of school building than the kind which served the educational needs of fifty years ago. In addition, there is an increasing community use of school buildings. This added use must also be reflected in the design and construction of modern school buildings. Both curriculum and teaching methodology plus the demands for community use of a school building have been changing over the years. This change can be expected to continue as technological advancement creates new needs which must be met and as research points the way to improved teaching methods. Flexibility and expansibility must, therefore, be incorporated into educational and architectural planning to the end that the constantly evolving program is not hampered by inflexible spaces and relationships.

As the concept of educational planning of school buildings has come to the fore, there has been extensive study concerning curriculum area requirements, the optimum sizes and relationships of the classrooms in these areas, and the types of lighting, heating, ventilating, furniture and room fixtures which best contribute to the realization of specific educational programs. Similar attention has not been focused on the school plumbing and fixture needs and requirements. This situation is reflected in a wide variety of practices and regulations from locality to locality. The lack of consistency and direction in this area is made apparent by the variations between code restrictions and actual practices among school districts which have similar educational programs and enrollments. Building and plumbing codes generally provide adequate protection to consumers of domestic water supplies through provisions regulating cross-connections, back-siphonage, venting, materials and other items related to health and safety. They have not been concerned with the sizes, numbers or locations of fixtures as they apply to the educational activities and their requirements.

Since school buildings are designed and constructed for one purpose—the education of the children who occupy them—plumbing facilities for schools and classrooms may be considered satisfactory only to the extent that they meet criteria of:

1. Educational utility
2. Ease of supervision
3. Sanitation
    a. Efficiency and safety in disposal of soiled water and wastes
    b. Ease of maintenance
    c. Protection of health
4. Location
    a. Within the building
    b. Within regular classrooms
    c. In special rooms
5. Functional design
    a. Internal arrangement
    b. Specific units
6. Size of fixtures
7. Number of fixtures
8. Safety
    a. Location
    b. Design
    c. Control

INITIATION OF THE STUDY

Since this is a problem to fixture manufacturers as well as to school planners, exploratory meetings were held during the autumn of 1955 by representatives of fixture manufacturing firms and School Planning Laboratory staff members. Other meetings were held, including those at the School Planning Laboratory. During the summer of 1956, specific areas of concern were defined and an overall plan was formulated.

The major areas of concern were:

1. Types and kinds of school plumbing fixtures.
2. Educational justification for special installations.
3. Status of the self-contained classroom.
4. The ratios of fixtures to school enrollments, particularly as regards group installations.

PATTERN OF THE STUDY

This study is an attempt to state in an organized, logical manner the needs of the various educational programs and grade levels within the American school system with respect to plumbing fixture installations. Thus, the investigation has been concerned with current practice and standards. The study was concentrated on school personnel—teachers, principals, superintendents, directors of maintenance, and others. From this population a sample of over ten thousand responses was drawn. Present usage and needs were determined by means of a questionnaire discussed in Section II. Responses from 9,645 teachers and from 404 building principals to this questionnaire were received.

One Staff member of the School Planning Laboratory traveled extensively throughout the United States to interview one hundred forty key individuals in pertinent educational, governmental, and professional positions.

Thirty-three cities in twenty states are represented by those interviewed and include, among others: Birmingham, Alabama; Berkeley, Los Angeles, San Diego, and San Francisco, California; Denver, Colorado; Atlanta, Georgia; Chicago, Illinois; New Orleans, Louisiana; Baltimore, Maryland; Boston, Massachusetts; Detroit and Saginaw, Michigan; Minneapolis and St. Paul, Minnesota; St. Louis, Missouri; Las Vegas, Nevada; New York City, New York; Cincinnati, Ohio; Portland, Oregon; Philadelphia, Pennsylvania; Memphis, Tennessee; Dallas, Texas; Salt Lake City, Utah; and Seattle, Washington.

The persons interviewed represent thirty-one different job-titles but may be classified roughly into the following categories: architects (17), building and plumbing inspectors (18), maintenance and operations personnel (41), miscellaneous (8). The accompanying table gives the detailed data concerning these people; their job-titles and the states in which they were employed.

In addition more than fifty building and plumbing codes from state and city government agencies were analyzed for content pertaining to requirements in school buildings. School building blueprints and specification sheets from major school systems including New York City, Denver, Oakland, Los Angeles, Chicago, and New Orleans were examined to determine the standards held in these systems.

The data from the questionnaires and interviews, from the analysis of codes, blueprints and specification sheets, and from faculty members have been synthesized into this report which has been written in three sections.

SECTION I

The educational program contains a concise description of the educational activities and the special plumbing requirements in each instructional area for the five commonly accepted grade groupings; Kindergarten, Primary grades (1, 2, 3), Middle grades (4, 5, 6), Junior High School (7, 8, 9), and Senior High School (10, 11, 12).

SECTION II

The Findings section is concerned with the organization and enumeration of data obtained from the personal interviews, questionnaire responses, and analyses of building and plumbing codes.

SECTION III

This section is based on the preceding sections and presents the recommendations of the survey staff on the kinds, numbers, design, sizes, and locations of plumbing fixtures necessary for an adequate educational program.

Early in the study a thorough investigation was made of the available literature on educational programs and their relation to school plant needs. Certain conclusions were reached on what constitutes a good educational program, what activities are carried on for educational purposes in the various general and special rooms of a school building, and what plumbing fixtures are necessary to carry on these activities.

Throughout this report the emphasis has been upon the educational aspects of the plumbing fixture problem. It does not deny the fact that where a comparatively large number of persons are gathered together, as in a school building, certain sanitary facilities must be supplied. From the public health viewpoint these facilities must be designed and installed so as to prevent transmission of disease and for ease of maintenance. But there are other implications to their installation which must not be overlooked, physiological relationships between plumbing fixtures and the health of the school child. The number, size, design, and location of toilets, showers, urinals, lavatories, and drinking fountains have a definite bearing upon the health habits of the child. The health aspects of plumbing fixtures are treated in the section on findings.

In addition to the sanitation, health, and safety aspects of plumbing fixtures in schools there are overriding educational aspects which must be kept in the forefront of any study such as this. The educational aspects range from the inculcation of good habits through training in the proper use of toilets and lavatories to the wider educational usage of plumbing fixtures in special areas such as science or home economics. The findings of this study as presented in the recommendations should be useful to educational and architectural planners, and to fixture manufacturers and installers in providing plumbing fixtures which help educate children for life in an increasingly complex world.

By presenting a number of school, classroom, and toilet area diagrams in the report, it is hoped that suggestions for better placement of toilet, drinking fountain and shower facilities will result. Throughout this investigation a need for better educational use of these facilities was stressed by the users. If this study results in these facilities becoming more recognized as a part of the learning process, it will have been worth the time and effort it has taken.

TABLE I. Personal Interviews: Position and State

The persons interviewed and the states in which they were employed.	TOTAL	Ala.	Calif.	Colo.	Ga.	Ill.	La.	Md.	Mass.	Mich.	Minn.	Mo.	Nev.	N.Y.	Ohio	Ore.	Penn.	Tenn.	Texas	Utah	Wash.
Architect	17	●	●		●	●				●	●	●					●	●	●		
Assistant Superintendent of Schools	6				●	●		●				●	●				●				
Building and Safety Inspector, City	1		●																		
Building Inspector, Board of Education	2									●									●		
Business Manager, Board of Education	14	●	●	●			●	●	●	●	●				●	●					
Custodian-Engineer, Individual Schools	4		●											●							
Director, City Plumbing Testing Laboratory	2					●				●											
Director, Construction Supervision, City	2						●														
Director of Curriculum, Board of Education	1																		●		
Director of Health and Sanitation, State	2				●		●														
Director of Maintenance and/or Operations, Board of Education	29	●	●	●	●	●	●	●	●	●	●	●		●				●	●	●	●
Director of Plumbing, Board of Education	2		●	●																	
Director of Research, Board of Education	2	●																		●	
Director of Sanitation, Board of Education	1													●							
Director of School Planning, Board of Education	10		●	●		●		●	●	●						●				●	●
Director of School Planning, State	3		●		●															●	
Mechanical Engineering firm	1																		●		
Plumbing Inspector, Board of Education	2						●												●		
Plumbing Inspector, City	6		●				●			●	●									●	
Plumbing Inspector, County	1		●																		
Plumbing Maintenance Foreman, City Public Schools	1														●						
School Planning Consultant, County	1		●																		
School Principal	6		●			●				●											
State Director of Surveys	1									●											
State Division of Sanitary Engineering	1																			●	
Superintendent of Schools, City	10		●							●		●	●	●	●		●				
Superintendent of Schools, County	1									●											
Superintendent of Schools, State	1																			●	
Supervisor of Construction, Board of Education	1																				●
Supervisor of Custodians, Board of Education	7		●	●			●		●		●									●	●
University Professors of Education	2			●															●		

I

The Educational Program and Plumbing Fixture Requirements

The principle that the only justification for plumbing installations in school buildings lies in the contribution they make to the educational program and to the health and welfare of the children has been set forth in the introductory statement as the basis of this study. It follows that the educational program common to each of the various grade levels must be examined, the activities outlined, and conclusions reached as to the plumbing installations necessary for the facilitation of these activities and the consequent learning process.

For the purposes of this analysis the twelve-year program has been divided into four parts: the kindergarten and primary grades (grades 1–2–3), the middle grades (grades 4–5–6), the junior high school (grades 7–8–9), and the senior high school (grades 10–11–12). Each of the grades in a given division has enough in common with the other grades in that division in curriculum and methodology to warrant such a grouping and to render unnecessary a grade-by-grade analysis.

The description of the educational program at the various levels which follows has been garnered through observation and experience and through review of the literature by the survey staff. The listing of plumbing requirements to facilitate the program has been arrived at by analysis of the learning activities and by observation of best practice in many schools throughout the nation. The listing of plumbing requirements thus arrived at serves as one of the bases of the final recommendations.

THE KINDERGARTEN

EDUCATIONAL PROGRAM

The kindergarten program provides a wide variety of learning experiences. The child learns to help other children, and to participate in class and group decisions; he develops work habits and a sense of responsibility commensurate with his own maturation. His natural curiosity is used to teach him more about nature and natural forces. He is taught desirable health habits, and is provided a physical environment in which he can practice them. He learns to compare different objects as to size and shape, and develops number competency in relation to his problems (how many glasses of milk). Vocabulary and oral communication are extended through sharing, telling stories and experiences, and identifying objects. He is given the opportunity to sing, to listen to suitable music, and to participate in various rhythmic activities. He develops and expresses creativity through the various art media and other manipulative materials, all of which aid in the improvement of fine muscle co-ordination as well.

The various learning experiences are provided in well planned but loosely structured activities which occur during the identifiable periods of the kindergarten "day." These include the work period, which consists of planning, working, cleanup and discussion; the free play; story-time and library; music and games; relaxation and rest. Equipment includes raw materials—clay, wood, paints—pattern toys, blocks, housekeeping equipment, wheel equipment, picture books, puzzles, rhythm instruments, a piano, relaxation mats, and many other items.

SPECIAL REQUIREMENTS

Physical areas within the kindergarten usually include: a wet corner for clay manipulation and painting as well as play with floating toys; a playhouse or housekeeping area; a building and construction area; a library or book corner which contains picture books and puzzles; a science area which contains an animal cage, aquarium, terrarium, planting boxes and display space; a music area; and outdoor play areas; with drinking fountains and toilet room facilities which are accessible to both the indoor and outdoor areas.

Since many of the activities in the kindergarten require water, a work sink readily accessible to the clay and painting area is essential. Such installations should be designed for the use of the children. Foot operated controls are desirable. Interceptor traps are recommended where sinks are used for clay work.

THE PRIMARY GRADES (GRADES 1-2-3)

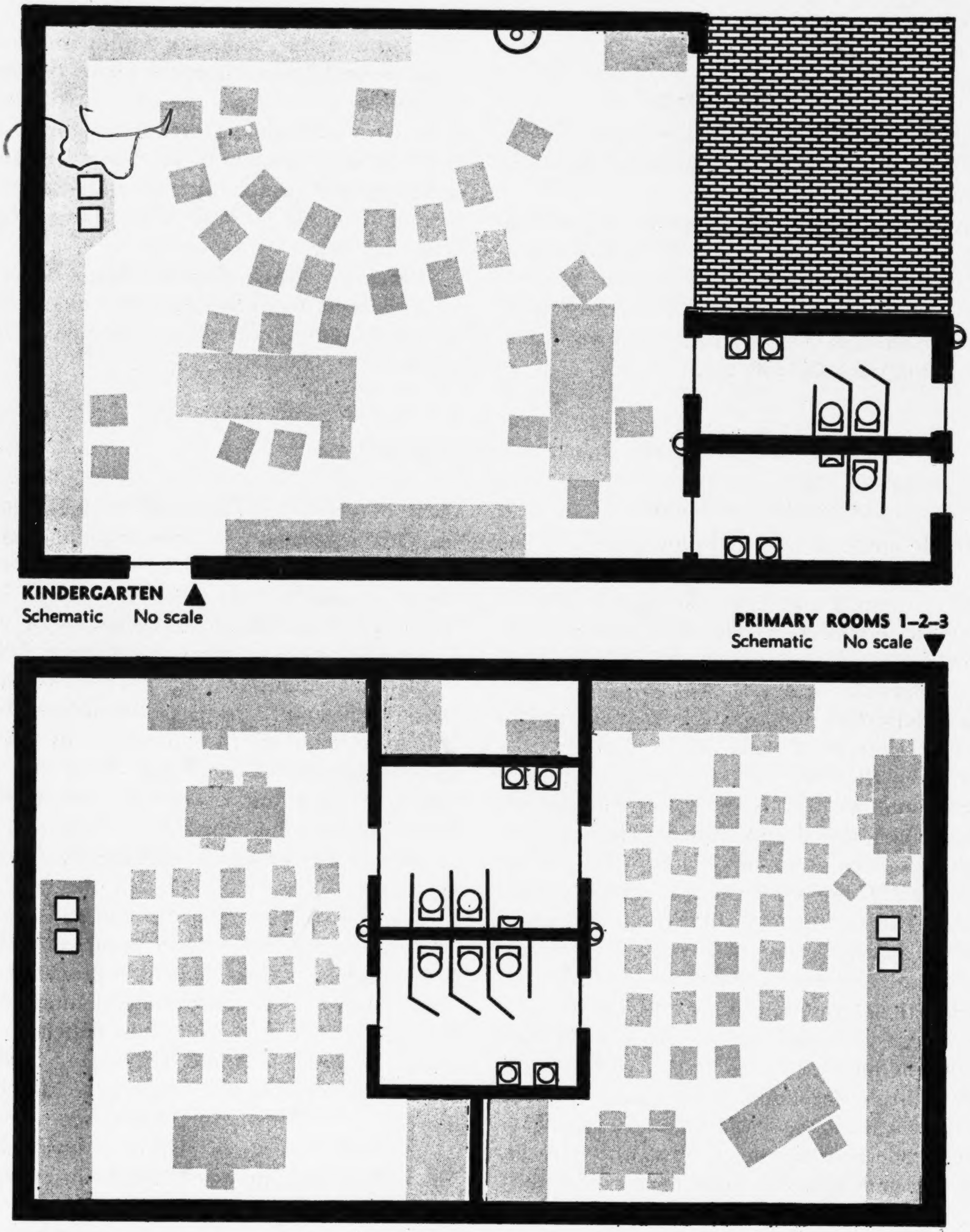
EDUCATIONAL PROGRAM

Education in the primary grades is a continuation of the kindergarten program, and is quite similar initially. The program emphasizes gradual development so as to include the more formal aspects of learning and instruction, but the break is not sharp. Informality generally prevails, and group movement within the teaching space is possible with a minimum amount of interference and disturbance. The educational program consists of "listening and doing" activities; short periods of concentration are followed by physical movement. Expression and appreciation activities, rest and relaxation, attending to body needs, working individually and in small groups are all a part of the day.

The primary school program provides meaningful experiences from many different areas. Art activities extend from a relatively simple two-dimensional drawing with paint, chalk, and crayons to more comprehensive and inclusive three-dimensional expression in dioramas, mobiles, and puppetry. Emphasis is continued on proper health habits, such as use of the handkerchief, washing, toilet training, putting things away, and obeying traffic rules. Children learn to listen and to understand directions, to enjoy music, poetry, and stories. There is an increased facility in speaking, talking, and conversing, while reading skills and competencies are initiated and strengthened. Expression of ideas through the written word is developed in harmony with the maturity and development of the child, accompanied by the beginnings of correct spelling and the use of simple punctuation marks.

Normal and meaningful number experiences are extended to counting up to approximately 200, telling time by at least five minute intervals, use of rulers and yardsticks, recognition of coins and the ability to make simple change, addition and subtraction through the two and three figure numbers, and multiplication and division of 2's. From the simple musical experiences an awarenes of high and low sounds, rhythm, and timing is developed. Children learn to move to music, to play rhythm instruments, to create new songs from their experiences, and to interpret music.

The guided play of building things, sand-box activity, make-believe, the simple ball skills, the small group games, and the rhythmic activities of the first grade gradually become more complex and extensive. Primary children learn about the different kinds of animals, rocks, plants, soils, the seasons and sound. Simple experiments in magnetism, plant growing and feeding, seed distribution, feeding pets and reflection of light are observed and conducted by the children. Displays, aquaria, terraria, observation of natural phenomena, as well as experiments with rust, statics, and simple machines are an integral part of the science sequence. In social studies, they learn about the family, the school, the neighborhood, the farm, the community, occupations, history, life elsewhere, use of maps and globes and geographic conditions. In all of the various activities of the primary school, construction of models, maps,



KINDERGARTEN
Schematic No scale

PRIMARY ROOMS 1–2–3
Schematic No scale

Key to symbols

- WATER CLOSET (FLOOR)
- WATER CLOSET (WALL)
- URINAL
- LAVATORY
- SHOWER
- DRINKING FOUNTAIN
- CUP FOUNTAIN
- WORK SINK (SINGLE)
- WORK SINK (DOUBLE)
- KITCHEN SINK
- CUSTODIAL SINK
- WASH FOUNTAIN

Figure 1

murals, mobiles, mats, pictures and other projects are necessary parts of the program.

SPECIAL REQUIREMENTS

Children are given increasing responsibility in the use of toilets, and less direct teacher supervision is required.

Since the educational program requires a ready source of water for use in various classroom activities, for clean-up and disposal of liquid waste, teachers and elementary administrators are almost universal in their demands for a work sink in the primary school work areas.

The lavatory or washfountains for use after toileting and the work sink within the teaching space serve different functions which do not lend themselves to multiple use of a single installation. The work sink, therefore, ought to be located in close proximity to those activities requiring water, preferably in the art-construction area, and should be fairly accessible to the outdoor play area.

Primary grade children should not be required to share toilet-room facilities with older children so special provision for these children should be made.

THE MIDDLE GRADES (GRADES 4–5–6)

EDUCATIONAL PROGRAM

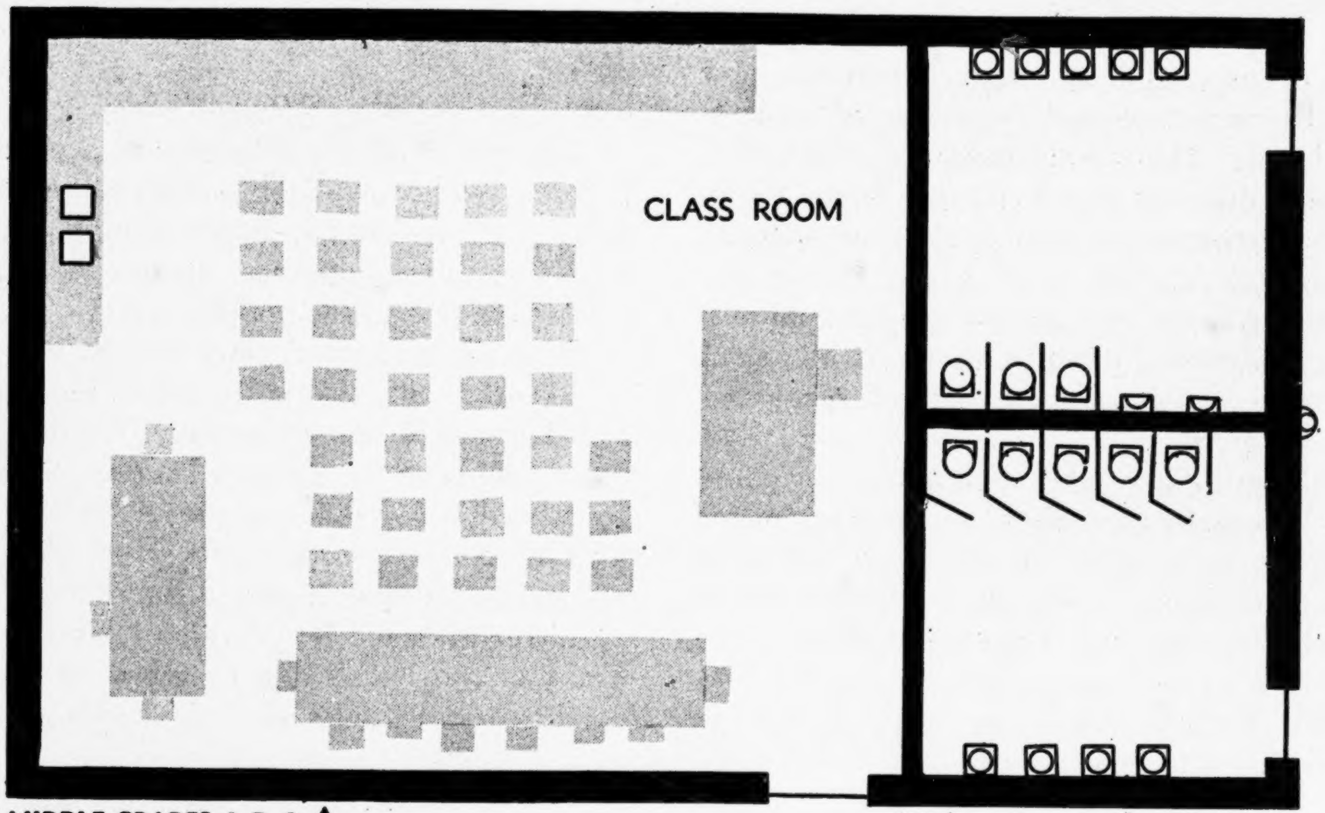
Middle grade educational programs build on, continue, and extend the learnings of the primary grades. Exploration and experimentation are the keynotes to the program. The children are on the threshold of social awakening—they are aware of how other people live and what other people want, and are adjusting their own lives accordingly. They need classrooms which are real learning laboratories for all of their activities. Their curriculum continues to provide direct experiences, experimentation, and dramatization. They cling to established patterns as they boldly strike out for newer ones. These are years of rapid growth for children, and the span of differences is greater. Some are hardly larger than primary children, while some are entering puberty.

Educational experiences are both broader and deeper. Art activities include work with two- and three-dimensional expression with various media. Murals, decorative maps, cartooning, bulletin boards, displays, sculpture, and masks have greater scope and complexity. Health education continues to emphasize behavioral evaluations, and provides more information about the body, the eyes, the teeth, ears, nose and skin. Eating habits, habit-forming substances, bacteria, minor first aid, and general care of the body are all covered.

In the language arts there is an expansion of critical and analytical listening and the development of greater organization in speaking. Vocabulary extension continues and children learn dictionary use, organization of ideas, use of such things as indices, glossaries, and initial library and reference materials. Emphasis is on variety of purpose and structure in sentences. Correct usage is taught and spelling and punctuation proficiency are emphasized. Children learn to read and write numbers of one million or more and to appreciate fractional time. They can recognize rectangles, and develop a concept of area. They can add and subtract fractions, can multiply two and three figure numbers, and learn long division.

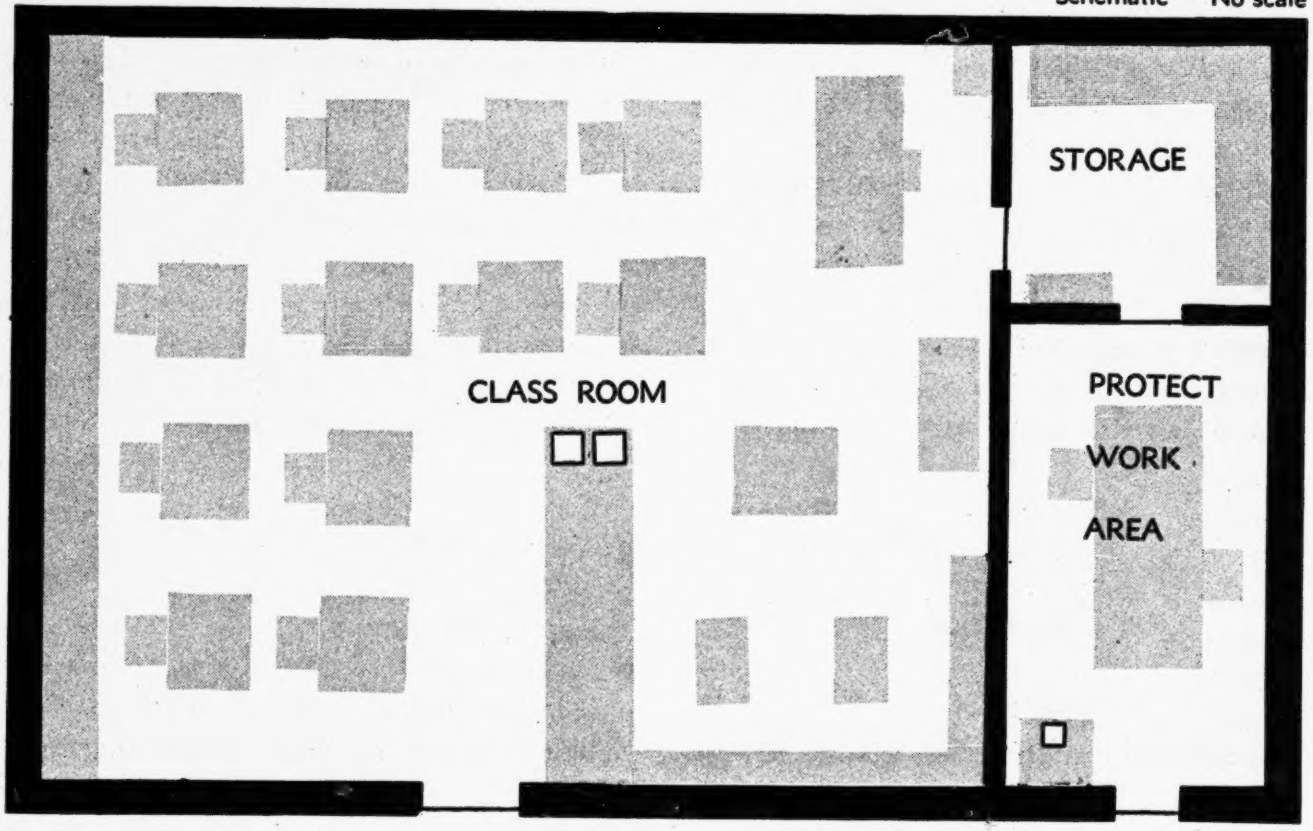
They learn to sing parts and to harmonize. They listen for the story in music, and sharpen their understandings and interpretation of it. They learn to play more complex music and instruments, and engage in folk dancing. Large group games are more important, while the stunts and rhythms are constantly extended to the age and maturity of the children.

Science education entails a good deal of model making and experimentation which reenforces learnings about the rotation of the earth, causes of wind, simple classifications of plants and animals, the uses of water, foodstuffs, the solar system, life cycles, sound, magnetism, erosion, and adaptation. Social studies lay further stress on how other people live, and to the development of insight on the influence of the



MIDDLE GRADES 4–5–6 ▲
Schematic No scale

▼ **ART CRAFTS**
Schematic No scale


STORAGE
CLASS ROOM
PROTECT
WORK
AREA

Key to symbols

- WATER CLOSET (FLOOR)
- WATER CLOSET (WALL)
- URINAL
- LAVATORY
- SHOWER
- DRINKING FOUNTAIN
- CUP FOUNTAIN
- WORK SINK (SINGLE)
- WORK SINK (DOUBLE)
- KITCHEN SINK
- CUSTODIAL SINK
- WASH FOUNTAIN

Figure 2

past on present day life. Skills are developed in the use of maps, globes, reference materials, and in the discrimination and evaluation of conflicting materials. There is sustained and intensified practice in dramatic living through group activities. Dramatization, reporting, class newspapers, supplemental readings, writing and telling stories, making maps and graphs, painting murals, making models and pictures, dramatic play, and many other activities are a part of the social studies program.

Although middle grade children are capable of and do actually concentrate on tasks for longer periods, the program is one of varied activities. Group enterprises, construction projects, panel presentations, and any of the many other kinds of learning experiences require a fluidity and flexibility of space. There are again identifiable areas within the space, including the science area, the construction and painting areas, and others.

SPECIAL REQUIREMENTS

The nature of the educational program requires a readily available supply of water for clean-up after painting and construction, as well as for the science activities. Hence, the need for a classroom sink in the middle grades.

Although individual classroom or two classroom-shared toilet rooms are still to be preferred at this age level, the increasing self-reliance and independence of the children leads to general acceptance of group toilet-lavatories. Where group toilet-lavatories are provided, they should be relatively small and dispersed through the building. Urinals should be provided for boys at this level and they should be designed, as all toilet facilities should, with the age and size of the users in mind.

THE JUNIOR-SENIOR HIGH SCHOOL YEARS (Grades 7–12)

Educational programs for 7–12th grade youth are developed in terms of the fundamental objectives for education in a democracy. These programs are designed to make substantial contribution to the production of better citizens, better workers, better parents, and better human beings. They help to improve daily living at school age, as well as adult living later. The programs help students meet some of their social and personal problems, and provide both leadership and followership experiences. The curriculum stimulates the desire to learn, and makes students increasingly better able to direct their own learning. Attention is given to meeting the broad objectives of self-realization, human relationships, economic efficiency and civic responsibility. These objectives are met through a variety of curricular patterns, and can be achieved in any kind of grade organization but are subject to limits often imposed by inflexible facilities.

THE JUNIOR HIGH SCHOOL (Grades 7–8–9)

GENERAL EDUCATION

PROGRAM

The educational program for grades seven, eight, and nine is often set up on the basis of a core program, characterized by a body of related course work under one teacher for a substantial part of each day. Although there are countless variations of such programs, they have the common need for teaching spaces adaptable to a wide variety of different kinds of activities. During the block of time, youngsters may do such things as read, listen, write, look up information, engage in panel discussions, work in small groups, make demonstrations, prepare maps, do related art work, construct models, and prepare displays.

SPECIAL REQUIREMENTS

Many of these activities are dependent on a ready source of water and most teachers in such programs consider the classroom sink as a necessity.

ART

PROGRAM

For the most part, art instruction for grades 7–9 is based largely on orientation and exploration. Students are not expected to attain a high degree of skill and proficiency in any of the several areas and media explored, although certain individuals will possess considerable skill. Generally, many art media are explored although practice will vary from school to school. Work will range from relatively simple line drawing, pictorial painting, lettering, and simple sculpture through beginning commercial art, display, advertising, and the various crafts.

SPECIAL REQUIREMENTS

Work sinks, designed with the special needs of the art program, are necessary in art rooms. Handwashing facilities—lavatories, counter-type sinks (hand or foot operated), or wash-fountains are also required.

BUSINESS EDUCATION

PROGRAM

Business education for grades 7–9 is usually concerned with a general exploration of the various business functions, services, and opportunities with some few introductory courses in elementary business procedures offered. Personal typing is often offered on the eighth or ninth grade levels, although some systems will provide courses in grade seven.

SPECIAL REQUIREMENTS

Although many business education courses will be offered in standard classrooms, typing classes require specialized rooms in which a lavatory is considered necessary. If the school paper is produced in this space, there is need for either a service sink or a classroom work sink for washing stencils and similar clean-up activities.

FOREIGN LANGUAGE

PROGRAM

Many systems have introduced beginning foreign languages prior to seventh grade, and by the ninth grade almost all systems have introduced foreign languages. The nature of the material of the course, e.g., vocabulary, grammar, literature, and the activities of the students, e.g., oral-aurial practice, reading, writing, do not require plumbing fixture installations in the classroom.

SPECIAL REQUIREMENTS

No plumbing fixture installations required.

MATHEMATICS

PROGRAM

Typically, students in grades seven and eight tend to take a common-learnings, required arithmetic course, while students in grade nine may be given a choice of electives or be required to carry one of several possible courses including algebra, basic mathematics, practical mathematics, business arithmetic, general mathematics, or remedial arithmetic.

SPECIAL REQUIREMENTS

No plumbing fixture installations required in the classroom.

LANGUAGE ARTS

PROGRAM

Basic common-learnings courses are usually required of all seventh, eighth, and nine graders, although there may be electives available in addition to the basic requirements. Required courses are typically listening, speaking, reading, and writing activities, which will include class discussions, chorus reading, dramatization, practice in parliamentary procedures, preparing and presenting reports, writing articles, and a variety of other activities.

SPECIAL REQUIREMENTS

Specialized classes within the language arts area require plumbing fixture installations. Speech-drama rooms, which usually have a platform or dias, require drinking fountains and journalism classes, if they publish the school newspaper, require a service sink.

SCIENCE

PROGRAM

Science programs in grades 7–9 generally emphasize effective learning in contemporary society and often are a part of an integrated science program extending through all levels of the school system. Problem-solving techniques and the development of scientific thinking are emphasized, and there is a discernible trend away from specific subject-centered values. Science learning activities take place through reading, displaying, discussing, experimenting, conferring, visualizing, studying, listening, creating and a wide variety of other methods of participation.

Usually seventh and eight grade science sequences will include health and safety, the surface of the earth, the atmosphere, water, plants and animals, astronomy, weather and climate, magnetism and electricity, energy, and other related items. Ninth grade units usually emphasize life science, although biology and a continuation of general science are offered in many schools.

The dynamic nature of science instruction suggests the desirability of providing teaching spaces which are flexible and adaptable to different kinds of programs and offerings. The multi-purpose science space adapts to several offerings.

SPECIAL REQUIREMENTS

An acid resisting sink, if chemicals are used, and water supply faucets with hose connections provided with vacuum breakers would be minimum facilities for a junior high school science room. Further needs would depend on the activities planned for students. Ninth grade science classes typically require a more extensive multipurpose laboratory with a number of student work stations than would be true for seventh and eighth grade science classes.

SOCIAL STUDIES

PROGRAM

Social studies programs for grades 7–9 are concerned with the further development of understandings and appreciation of social structures. This may take the form of a study of the contributions from the past or from other cultures, or it may emphasize local, state, and national structures. Instruction may be conducted both individually and in groups.

SPECIAL REQUIREMENTS

The social studies is typically a part of the core program in which all students are involved. The classroom sinks recommended for that instructional area are in particular demand by the social studies teachers in the junior high school as aids in the expression and construction phases of the program where clean-up and liquid waste disposal are necessary.

THE SENIOR HIGH SCHOOL (Grades 10–11–12)

ART

PROGRAM

Art programs in grades 10–12 are an extension and refinement of previous art experiences. In the general education program art is emphasized as an important social force influencing many aspects of daily living. An attempt is made to develop maximum creativity in each person through a well-balanced program providing a wide variety of experiences. Activities may vary from rather elementary design, lettering, sketching, coloring, layout, jewelry, metal craft, ceramics, weaving, sculpturing, cartooning, illustration and other media to advanced and extended studies in these areas.

SPECIAL REQUIREMENTS

Clean-up, storage, toilet and lavatory facilities of sufficient amount and proper kind to serve the program and the enrollments must be provided, although specific art laboratory plumbing installations are dependent on the different kinds of programs offered and the various media which are employed.

BUSINESS EDUCATION

PROGRAM

Business education in the secondary school generally, and in the senior high school especially, is designed to serve at least three somewhat overlapping purposes: (1) Personal use skills, such as functional typewriting, are developed for many different students having varying interests and vocational objectives; (2) General education contributions—development of an awareness and understanding of the business world and its relation to everyday life—are made through such courses as general business and consumership; (3) Vocational training—(salable skills for initial job placement and subsequent growth on the job)—is given for those students having the aptitude, inclination, and the need to go directly to work in the field of business.

SPECIAL REQUIREMENTS

In spaces where stencil work, ribbon changing, duplication, and related activities take place, there is need for a lavatory, washfountain or a work sink.

FOREIGN LANGUAGES

PROGRAM

The study of modern foreign language is undertaken to gain a communicating competence in the language, while Latin and Greek are taken largely to provide background for the understanding of English and to meet certain later college requirements.

SPECIAL REQUIREMENTS

Neither the material nor the methods and the activities require plumbing fixture installations, although classes structured around cultural studies of the respective foreign nations in which costumes may be prepared, and paintings made may require classroom sinks.

LANGUAGE ARTS

PROGRAM

Traditional language arts courses. often tightly structured around listen-read-write-discuss grammar and literature activities, have little occasion to use plumbing fixture installations. However, changing methods and activities, involving considerable informal dramatization as well as construction and design, are creating a need for plumbing fixtures. Certain language arts electives which should be conducted in special laboratories rather than regular classrooms are: Drama, Stagecraft, Speech and Journalism.

SPECIAL REQUIREMENTS

No special plumbing fixtures are needed in regular classrooms. The dramatics laboratory requires grooming sinks for make-up instruction and activities and the stagecraft laboratory requires a work sink or hand-washing facilities. The speech laboratory requires a drinking fountain. A hand-washing sink is necessary in the journalism laboratory.

MATHEMATICS

PROGRAM

Mathematics offerings are usually of two or three types: the college preparatory sequence, consisting of algebra, geometry, advanced algebra, solid geometry, trigonometry, and, for the gifted, analytics and beginning calculus; the general mathematics sequence consisting of applied arithmetic, general mathematics, consumer mathematics, etc.; the specialized offerings such as business mathematics, mathematics for shop.

SPECIAL REQUIREMENTS

The nature of the materials covered and the methods used do not require plumbing installations, although in certain situations using varieties of manipulative and constructed materials, wash-sinks would be needed.

SCIENCE

PROGRAM

At least one year of science is required generally of all students in the senior high school, with the trend toward a requirement of two years in grades 9–12. Often, biology or other life sciences are offered during the ninth year, with physical science of some sort offered in the tenth year, while chemistry and physics and advanced life sciences are offered to eleventh and twelfth graders. Class sizes in the laboratory sciences have been moving upward until now it is quite common to plan for 28 students in each class rather than 24.

SPECIAL REQUIREMENTS

Spaces providing perimeter installations of sinks, water, gas, and electricity are both more flexible and more economical than are single purpose rooms providing island work stations.

Biology and general science require a laboratory furnished with a minimum of 14 two-place student stations, a demonstration table with sink, water, electricity, and gas, and a counter (perimeter) station containing not less than two sinks with gas, water and electrical outlets.

Physical science requires essentially the same kind of laboratory as biology.

Chemistry requires 28 work stations, perimeter mounted, with movable student stations which would be used in the center of the room for lecture, demonstration, etc., and which would move to the perimeter stations for the laboratory activities. Each perimeter station requires access to sink, water, gas, and electricity.

Physics could be offered in a general purpose room, or in a room used for some of the chemistry classes.

SOCIAL STUDIES

PROGRAM

Senior high school social studies programs are generally designed to further develop the basic social concepts through both depth and breadth extensions of content. Students are assisted to acquire the ability to analyze and interpret events and to assume the rights and responsibilities of citizenship in a dynamic society.

SPECIAL REQUIREMENTS

In those classes in which construction projects are widely used, a work sink in the classroom is required.

SPECIALIZED AREAS COMMON TO JUNIOR AND SENIOR HIGH SCHOOLS

HOMEMAKING

PROGRAM

At the junior high school level homemaking is an exploratory course for girls and, to an increasing degree, boys as well. Experiences are provided in:

Selection, preparation, service, conservation and storage of food for the family;

Selection, care, renovation, and construction of clothing;

Maintenance of satisfying personal, family, and community relationships;

Care and guidance of children;

Selection and care of the home and its furnishings;

Selection, use and care of home equipment;

Maintenance of family health;

Home care of the sick;

Selection and purchase of foods, clothing, equipment and housing, and furnishings.

Homemaking courses at the senior high school level tend to explore the same areas in greater depth and breadth.

SPECIAL REQUIREMENTS

In all-purpose homemaking laboratories, sink installations, a food waste disposer and a clothes washer are required. In the more extensive homemaking suites a sink is necessary in the clothing area and two wall lavatories should be provided in the fitting and grooming section. The bedroom area requires a tank water-closet and a wall lavatory. In specialized foods classrooms unit kitchens for each four to six pupils are supplied. Each unit requires a sink with hot and cold water, and one sink equipped with a waste disposer. In some classrooms a dishwasher is installed.

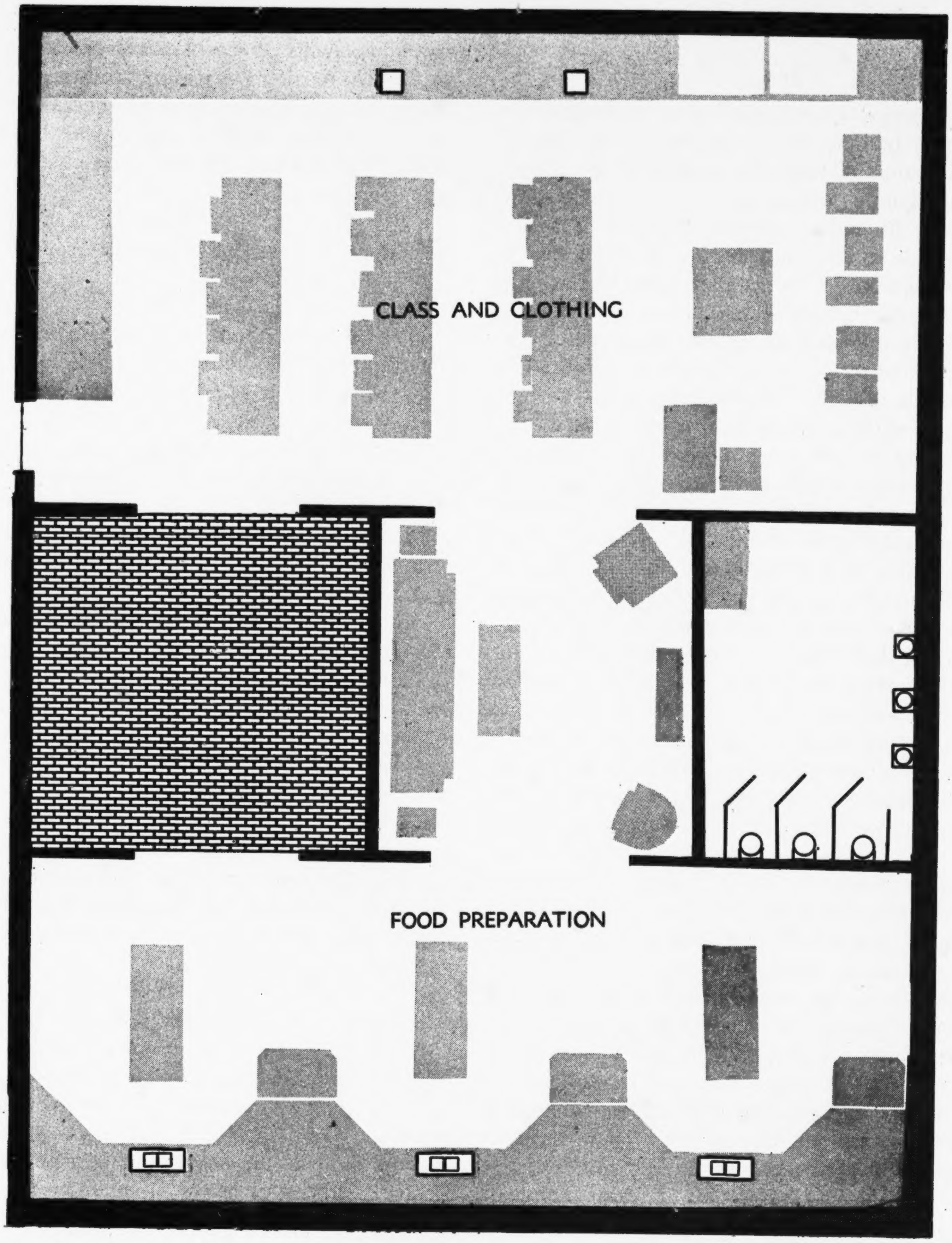

CLASS AND CLOTHING
FOOD PREPARATION

Figure 3
HOMEMAKING
Schematic No scale

Key to symbols

- WATER CLOSET (FLOOR)
- WATER CLOSET (WALL)
- URINAL
- LAVATORY
- SHOWER
- DRINKING FOUNTAIN
- CUP FOUNTAIN
- WORK SINK (SINGLE)
- WORK SINK (DOUBLE)
- KITCHEN SINK
- CUSTODIAL SINK
- WASH FOUNTAIN

INDUSTRIAL ARTS

PROGRAM

Instruction in industrial arts is designed to interpret the machine age to the students and to prepare some of them for vocations in industry.

In beginning courses there is a broad development of skills and acquisition of knowledge which is valuable to any student, regardless of his future occupation, whereas more advanced experiences provide pre-vocational training which must usually be followed by specific vocational training in technical-industrial institutions, on-the-job, or through an apprenticeship situation.

Some of the general concerns of industrial arts instruction include: planning and completion of projects which require a variety of tools and materials; developing an increasing understanding of the contribution of industry to ordinary living; reading and making working drawings of various projects at different levels of skill and maturity; developing the ability to recognize quality materials, thus leading to more effective consumership; learning to service some of the common products normally used in the home; developing the communications competencies applicable to industrial arts; developing competency and interests related to the various media and areas for lifetime avocational and hobby benefits; and augmenting the social understandings through working with others.

Basically, industrial arts instructional experiences depend upon manipulative learning with such things as demonstrations, reading, visual aids, and field trips comprising less than a fifth of the time. The project approach, with its consequent analyses of processes, is widely used. The usual pattern is to provide general exploratory experiences in the junior high school, often in a comprehensive general facility. These general and wide experiences are usually followed by more specialized experiences in both comprehensive general shops and in unit shops.

SPECIAL REQUIREMENTS

Educators are unanimous in requesting handwashing facilities in each shop and many prefer toilet-lavatory facilities within the shop area, especially for the use of instructors who, because of the necessity for constant supervision, may not be able to use more distant facilities. Student toilet-room facilities in a readily accessible location in the general shop area are necessary for student control and for adult use during night school programs.

PHYSICAL EDUCATION

PROGRAM

The physical education program is directed toward the development of general health and physical well being, proficiency in certain skill areas, discovery of interest areas possessing carry-over into later recreational activities, experiences in working and playing with others, and relaxation from tensions.

There is an increasing emphasis on individual and dual activities and on co-educational programs.

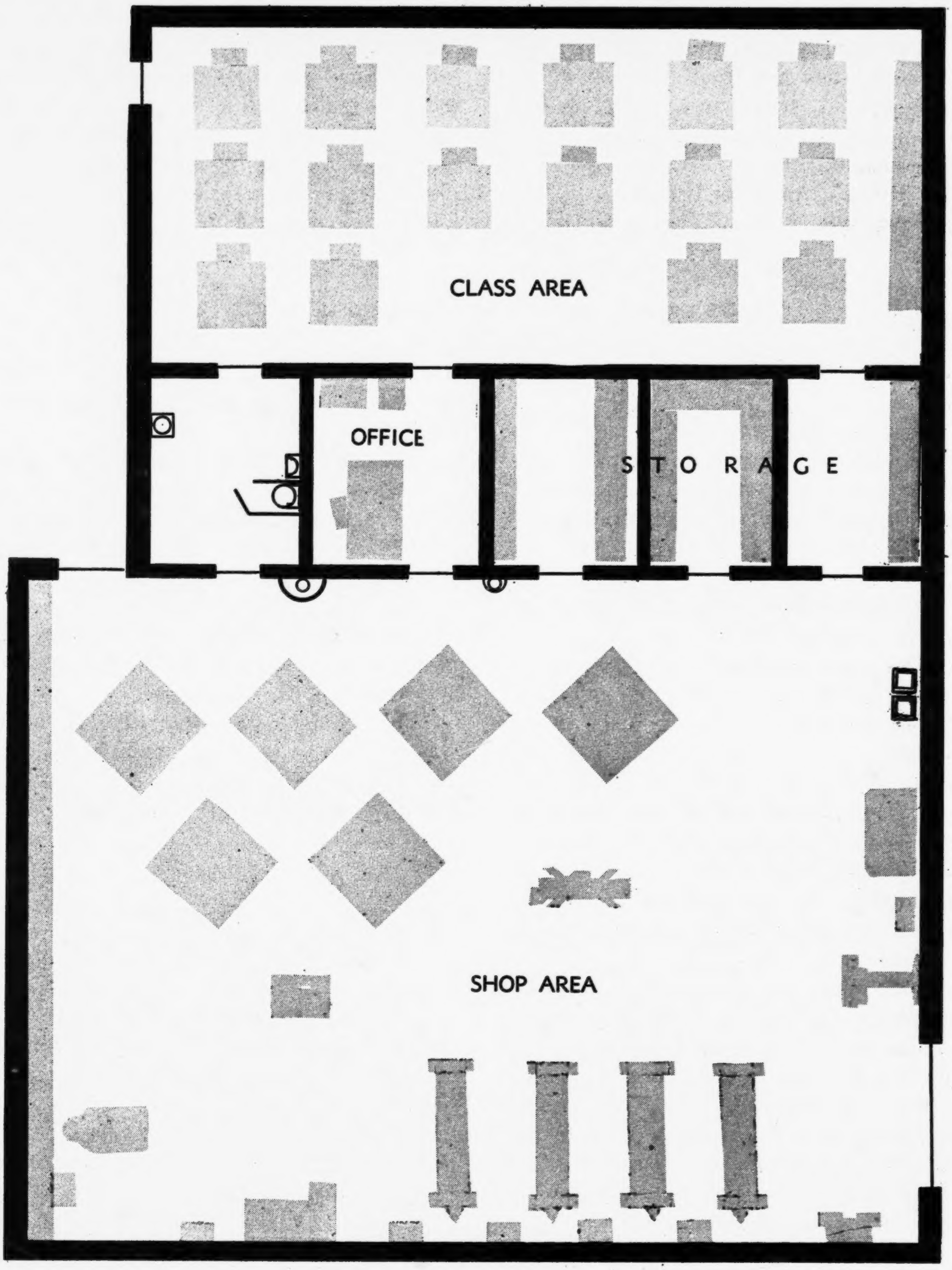
Gymnasium facilities are seldom provided in elementary schools designed to serve K–6 youngsters, although they are often provided in K–8 schools and in junior high schools. Playrooms are commonly planned for the K–6 schools. They also serve as lunchrooms and as dramatic and musical production centers for the schools.

Joint endeavor by the community, the recreation department, and the school district often results in the development of various recreational facilities usable by many different groups throughout an extended day and an extended year.

SPECIAL REQUIREMENTS

Showers are considered essential for grades 7–9, as well as for the senior high school. There should be a sufficient number of individual shower heads to enable everyone in a physical education class to have a shower during the time allowed. Group showers for boys and for girls are satisfactory, although it is typical practice to provide some individual shower stalls for the girls. From the students' standpoint, it is desirable to have shower heads of a type and at a height that makes it possible to shower without getting the hair wet.

The type of shower controls used depends somewhat on local policy and philosophy, but


CLASS AREA
OFFICE
STORAGE
SHOP AREA

Key to symbols

- WATER CLOSET (FLOOR)
- WATER CLOSET (WALL)
- URINAL
- LAVATORY
- SHOWER
- DRINKING FOUNTAIN
- CUP FOUNTAIN
- WORK SINK (SINGLE)
- WORK SINK (DOUBLE)
- KITCHEN SINK
- CUSTODIAL SINK
- WASH FOUNTAIN

Figure 4
INDUSTRIAL ARTS
Schematic No scale

all should have a non-scald feature. In group shower installations it is important that the soiled water from one shower station not drain to another. The separate drying area requires a floor drain.

Toilet rooms adjoining the locker rooms are necessary. If the gymnasium is used for spectator sports, provision is usually made for public toilet rooms. Drinking fountains near outdoor exercise areas and in the gymnasium are necessary to meet physiological needs. Quite often a cuspidor is installed in the gymnasium. Plumbing fixtures in the gymnasium must be protected for the safety of rapidly moving students. A separate toilet, lavatory and shower are often supplied for the teachers of each sex.

SPECIALIZED AREAS COMMON TO ALL GRADE LEVELS

ADMINISTRATION

PROGRAM

Practice varies widely in terms of actual administrative spaces provided and their location. Size of school, district policy, administrative services provided, and community standards all affect the extent and arrangement of facilities. In some situations the administrative unit will contain offices for the principal, his assistants, e.g., vice-principal, assistant principal, deans, reception areas for the public and for students, a base of operations for specialists, e.g., reading and speech correctionists, psychologists, psychiatrists, curriculum specialists, and supervisors, complete health facilities, general office and workroom facilities, space for the public address system and the programming system. In other situations minimum facilities are provided and some of the services are not available or are provided in shared facilities.

Even with minimum or dispersed facilities, the administrative area is the focal point for the routine business of the school. Teachers pick up mail and other communications in the area, while students will come to the area for attendance details, programming, and other reasons. Peak student and teacher loads are before school starts, after school, and during the noon hour, while public visitors may arrive at any time.

SPECIAL REQUIREMENTS

Until recently it was standard practice to provide a principal's toilet-lavatory immediately adjacent to the administrative office. It is now common practice for the principal to utilize the teachers' facilities and an attempt is usually made to locate the lounge and workroom in close proximity to the administrative area.

The health room or suite requires toilet-room facilities as well as work sinks. In larger schools, which provide complete health services with a full time nurse on duty and scheduled hours for doctors and dentists, fairly elaborate facilities will be required.

The teachers' lounge and workroom will require separate toilet-room facilities for each sex and a work sink.

The guidance area usually has private conference rooms and a waiting room for students. The area should be readily accessible to toilet-room facilities as well as to drinking fountains.

LIBRARY

PROGRAM

The library is located most effectively in a prominent and easily accessible area of the plant. The library is the service center for the distribution and utilization of all kinds of instructional materials, including books, periodicals, maps, models, recordings, and other audio-visual materials. Although many elementary schools do not provide central libraries of this type, there is a definite trend toward such provision. Regular instruction in the use of the library is usually a part of the educational program for all students.

SPECIAL REQUIREMENTS

When the librarian is responsible for book repairs, binding, receiving, and loaning it is convenient to provide a work sink having both hot

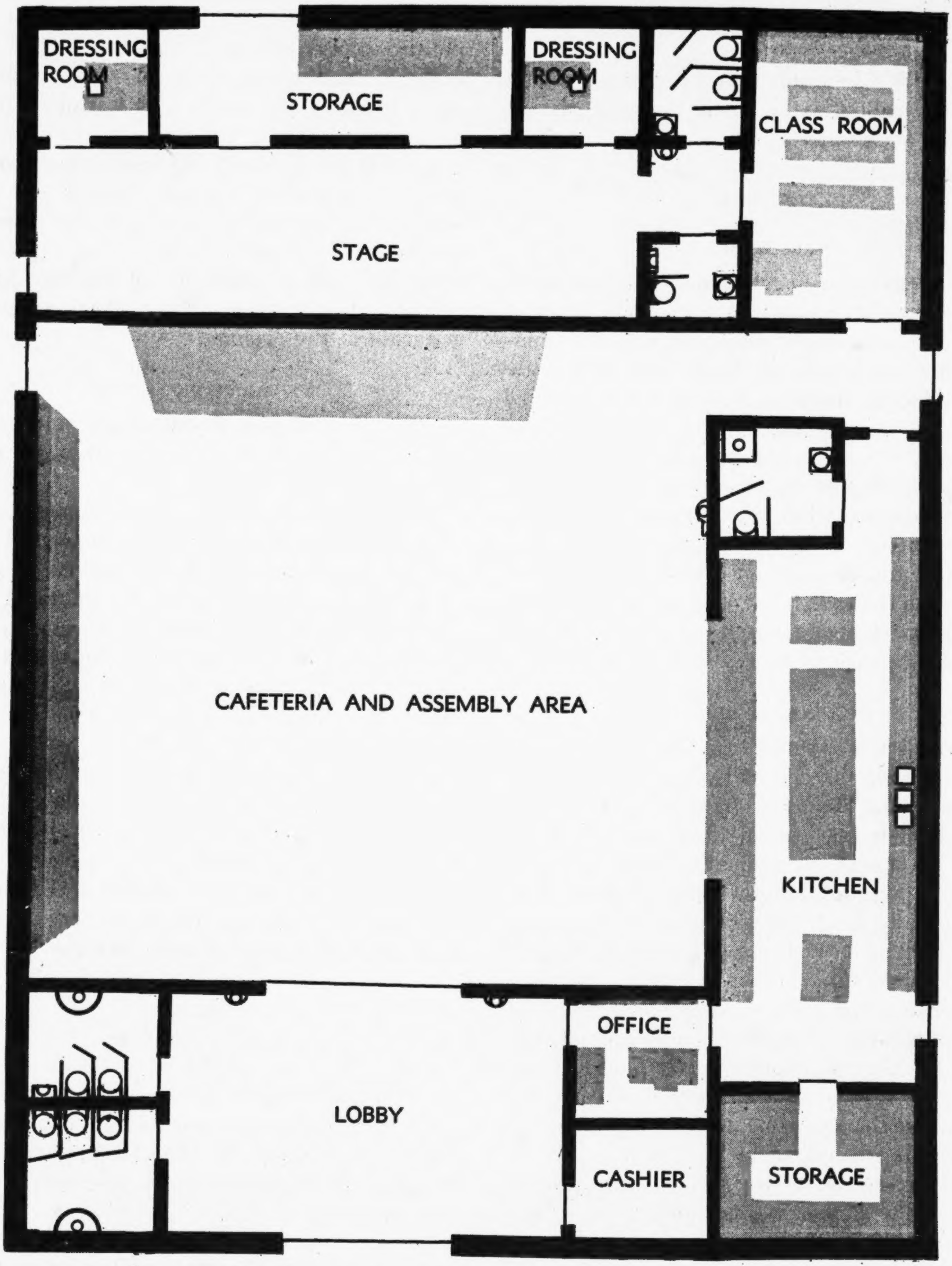

DRESSING ROOM
STORAGE
DRESSING ROOM
CLASS ROOM
STAGE
CAFETERIA AND ASSEMBLY AREA
KITCHEN
OFFICE
LOBBY
CASHIER
STORAGE

Figure 5

MULTI-USE AREA

Schematic No scale

Key to symbols

- WATER CLOSET (FLOOR)
- WATER CLOSET (WALL)
- URINAL
- LAVATORY
- SHOWER
- DRINKING FOUNTAIN
- CUP FOUNTAIN
- WORK SINK (SINGLE)
- WORK SINK (DOUBLE)
- KITCHEN SINK
- CUSTODIAL SINK
- WASH FOUNTAIN

or tempered and cold water, with collateral work space.

A drinking fountain may be desired within the main reading space, or at least one should be readily accessible.

CAFETERIA

PROGRAM

Wide variations in solution to the hot lunch problem exist, depending in part on the services anticipated, scheduling practices, and the number of meals to be served. Many systems provide a central food preparation and eating space where all of the children who participate in the program are served. Other schools have their own kitchen, but provide smaller eating spaces rather than a single large space, while others transport the foods from the kitchen to the classrooms. In other districts, a central kitchen is provided for the preparation of all the food for several different schools, and the food is then transported in suitable containers to the various schools for consumption.

SPECIAL REQUIREMENTS

It is desirable to provide drinking water within the main eating space; usually both drinking fountains and glass fillers are provided at the senior high school level. Student toilet-room facilities should be located conveniently to the cafeteria, but not within the cafeteria space. Handwashing before eating is an integral part of functional health; consequently, handwashing facilities must be readily accessible and of sufficient capacity to accommodate the numbers of students involved. Some school systems provide hand-washing facilities within the main eating space, or in the corridors immediately adjacent, although some systems believe that conveniently located toilet-room installations are sufficient.

Toilet-room and shower facilities are desirable for use of the kitchen workers and in some states are required.

AUDITORIA OR MULTI-USE ROOMS

PROGRAM

Fewer auditoria are appearing in elementary school plans than formerly, although more multi-purpose rooms are being constructed. Generally an auditorium or multi-use room is provided in junior and senior high schools. There is no common pattern, however, and facilities provided and justified vary from elaborate auditoria to minimal spaces. School districts and other agencies are more often developing facilities, like auditoria, co-operatively, with the expectation that they will be used during the day for the school's educational program and for community activities in the evening.

SPECIAL REQUIREMENTS

For the most part, K–6 dramatic activity does not require elaborate dressing rooms, or toilet-room facilities.

If junior or senior high school dramatics, stagecraft, and related activities are to be housed in the plant, it is necessary to provide the dressing rooms with lavatories, work sinks, or grooming sinks needed for make-up. Stagecraft requires a work sink or other handwashing facilities. With regularly scheduled classes in the area, lavatory facilities are often included as a total part of the school needs.

Drinking fountains should conveniently be provided for both the seating and stage areas.

If the facilities are to be used for public performances and gatherings, it is necessary that toilet-room facilities be available in the vicinity, although it is fairly common practice to utilize conveniently located student facilities.

MUSIC

PROGRAM

Music offerings for grades K–6 and grades 7–9 vary from relatively unstructured and informal homeroom singing up through harmony; from beginning instrumentation to relatively finished performances.

Senior high school music experiences are designed to provide the opportunities for emotional outlet, creative expression and performance skill development. Offerings are planned to serve students who will range widely in both interest and performance competency.

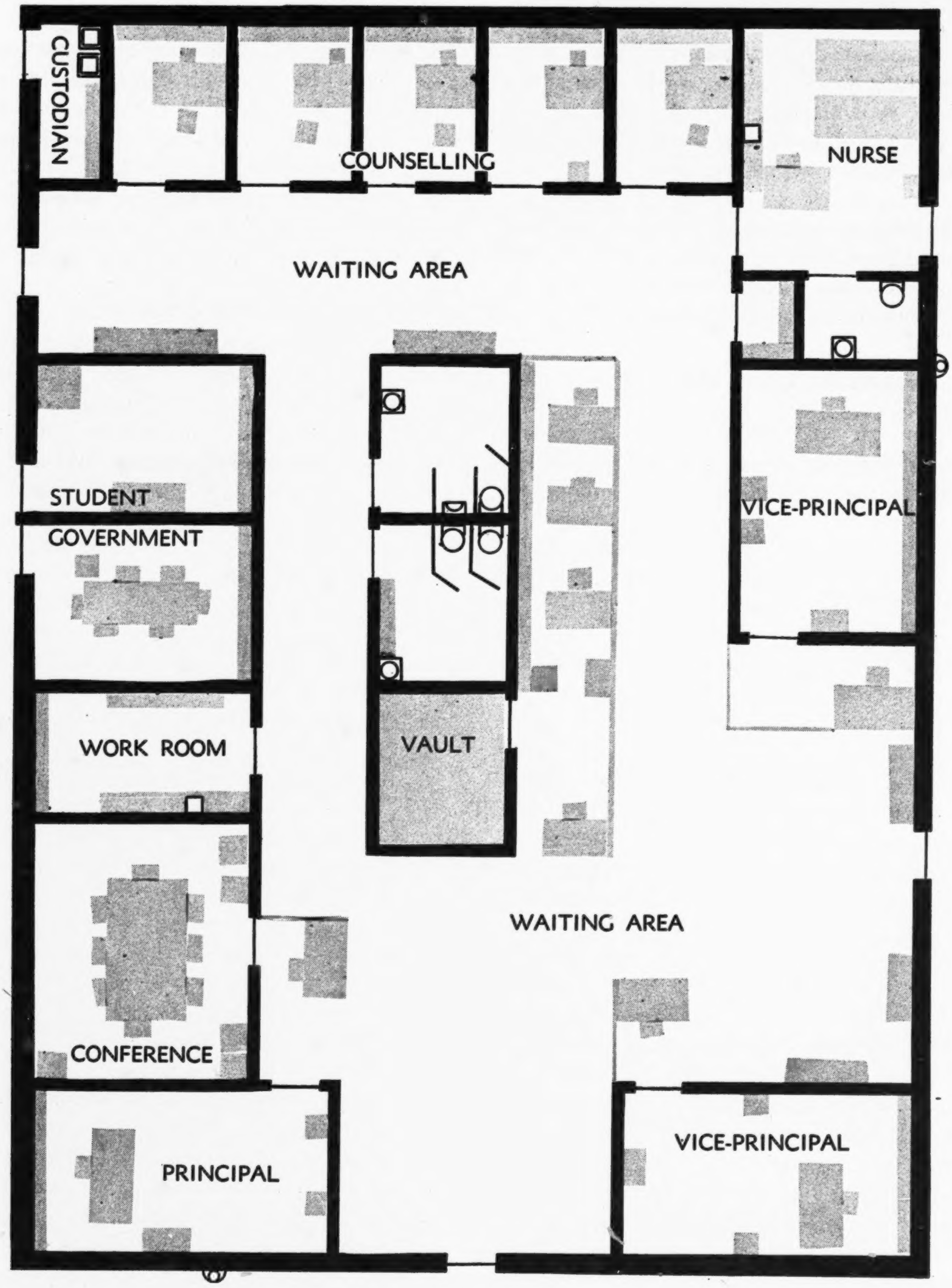

CUSTODIAN
COUNSELLING
NURSE
WAITING AREA
STUDENT GOVERNMENT
VICE-PRINCIPAL
WORK ROOM
VAULT
WAITING AREA
CONFERENCE
PRINCIPAL
VICE-PRINCIPAL

Figure 6
ADMINISTRATION AREAS
Schematic No scale

Key to symbols

- WATER CLOSET (FLOOR)
- WATER CLOSET (WALL)
- URINAL
- LAVATORY
- SHOWER
- DRINKING FOUNTAIN
- CUP FOUNTAIN
- WORK SINK (SINGLE)
- WORK SINK (DOUBLE)
- KITCHEN SINK
- CUSTODIAL SINK
- WASH FOUNTAIN

SPECIAL REQUIREMENTS

Music teachers desire drinking fountains within the teaching areas. Soaking reeds, felting, and instrument repair require a work sink with a needle spray as well as a faucet in the department, usually in an office or workroom. Boys' and girls' toilet-rooms are advised for the department or the immediate area when the music facilities are isolated from other components of the school plant and especially if they are used evenings for student productions and adult classes.

MAINTENANCE AND OPERATIONS

PROGRAM

Physical facilities are needed for the regular custodial and maintenance staffs. Routine operational tasks require tools like mops, brooms, brushes, dust cloths, cleaning materials, wax, ladders, etc. These materials should be conveniently stored on each floor or in each wing so that the custodians will not spend too much valuable time running after tools and supplies.

Maintenance crews, whether school stationed or district stationed, require a base of operations within the school, usually a small work shop.

SPECIAL REQUIREMENTS

Water is needed for many of the daily operational tasks, and must be readily available; the usual practice is to provide a custodial closet, with realistically planned storage space for the normally used tools and equipment, and with either a service sink or a mop sink.

◆

II

Summary of Survey and Field Work

GENERAL

Knowledge concerning present practice and current regulations in building and plumbing codes with respect to plumbing installations in schools was needed as a base point in this study. Also needed were the opinions of school administrators and architects on the adequacy of present practice and regulations with respect to the health, safety and educational worth of school plumbing installations, and the ideas of these persons on what should be done to correct existing inadequacies.

Accordingly an extensive program of information seeking was initiated. Simple questionnaires were sent out to thousands of teachers throughout the nation. More extensive questionnaires were sent to building principals. In addition, a rather wide distribution of superintendents and directors of maintenance in school systems, and architects and educational planners were interviewed. A wide selection of plumbing and building codes, and recommendations of recognized national organizations was analyzed for content.

As a further check on adequacy of present practice a time-use study of toilet-room facilities was made in representative school buildings at all three levels—elementary, junior high school and senior high school.

It was not the intention in setting up the design of this study to make it a statistical study of data gathered by the questionnaire method. It was rather to bring to bear on the study a variety of research procedures including questionnaires, interviews in depth, code analysis, observation, field study, time-use study, logical analysis, analysis of correspondence, and review of the literature.

The variety of research procedures made it possible to develop cross checks, to fill in gaps in information, to check on maintenance problems, to develop and then test hypotheses, and, by consultation with experts, to answer questions which arose.

Questionnaire to Teachers

A questionnaire designed to reveal factual and attitudinal information was distributed to teachers in school districts which were contacted in advance and had agreed to cooperate.

This first questionnaire, which was pre-tested in school districts in the neighborhood of Stanford University and corrected where ambiguities appeared, sought four sets of responses: (1) What plumbing fixtures are now in your classroom?; (2) What plumbing fixtures do you need to carry out your educational program?; (3) How would the installations requested contribute to the educational program?; (4) What suggestions do you have for improving plumbing fixture installations throughout the entire school?

Responses from 9,236 classroom teachers were received. The number of pupils enrolled in the responding schools numbered more than 270,000. The totals indicate that the sample can be considered representative.

As the study progressed a second questionnaire was prepared to reveal more detailed opinions from teachers on such aspects of the problem as the desirability of certain plumbing fixtures and the height of toilets and urinals, lavatories and work sinks. There were 409 responses to this questionnaire.

A summary of the total number of responses from both the first and second questionnaire categorized by grade group and by size of school is presented in Table 2. Also given is the number of children in the classrooms of the teachers responding.

The table indicates that responses in significant numbers were received from teachers in all sizes of schools and at all grade levels. The largest group of responses came from teachers of the primary grades in schools with enrollments of 501–1000. In total there were 9,645 respondees from schools with a total enrollment of 282,567 pupils.

A much more complete questionnaire was sent to building principals in elementary, junior high, and senior high schools across the United States. There was a total of 404 returns. The numbers of returns was almost 100 per cent, since the forms were sent only to those who had been selected on the basis of geographical areas, grade levels, and size of community and who had previously indicated a willingness to participate in the study.

Examination of these principals' reports indicates a range of ratios for toilets for boys at the secondary level of 1:10 to 1:118. The modal responses for actual use fell in the 1:35 to 1:39 category. Sixty-three per cent of those reporting had no urinals for the boys, which accounts in part for the relatively high ratios.

One hundred per cent of those stating that present facilities were inadequate indicated location as a factor of inadequacy. Ninety per cent also included supervision as a factor.

The ratios of toilets for girls ranged from 1:10 to 1:24, with the modal responses evenly distributed from 1:15 to 1:35, and with another cluster at 1:40 to 1:49.

Two of those indicating dissatisfaction with the number of toilets for girls had existing ratios of 1:25 to 1:33. The ratios of the others who indicated dissatisfaction ranged from 1:45 to 1:90.

Of those reporting dissatisfaction with the toilets in use for boys, one had a fixture : pupil ratio of 1:34, the rest had ratios ranging from 1:80 to 1:118.

Elementary ratios in use ranged from 1:10 to 1:80 for boys and from 1:10 to 1:79 for girls. A pattern similar to that at the secondary level was evident; dissatisfaction in number of facilities being very closely related to poor location and poor supervision.

The principals' reports did not include those facilities which are normally recommended to serve industrial arts, auditorium, and outside play areas. Instead of increasing the number of fixtures necessary, these peripheral area facilities should provide a better distribution of the total facilities and allow for a more uniform pattern of use. This reduces the peak loads for which the number of fixtures have to be planned.

Also, the present trend for single story buildings and the dispersion of facilities cut down the distances and times necessary to reach the facilities and return. When a pupil passes within a few feet of the facilities, he can use them then. On the other hand, should he have to go to the center of the building or down or up one, two, or three flights of stairs, he has to wait until a longer period of time is available than that permitted between classes. If this is true for just half the students, congestion and nearly unmanageable peak loads must necessarily result. This is a reiteration of the principle that the number of fixtures is, to a large degree, a function of the location and the school program.

Far too often rehabilitation of plumbing facilities in existing school buildings has consisted of increasing the number of fixtures in the present toilet areas rather than dispersing the fixtures to make for a more uniform and satisfactory pattern of use.

Greater flexibility in the high school program such as the staggered lunch periods and morning recesses make for better utilization.

THE TIME-USE STUDY

A time-use study of toilet rooms and the fixtures in them was made in three elementary schools, a junior high school and a senior high school in the San Francisco Bay Area. The study was undertaken to get a measure of actual practice in school buildings, all of which were less

TABLE 2. Number of Responses to Plumbing Fixture Survey by Grade Group, Enrollment and Size of School

GRADE GROUP

SIZE OF SCHOOL	KINDERGARTEN		GRADES 1–3		GRADES 4–6		TOTAL 1–6		JUNIOR HIGH SCHOOL		SENIOR HIGH SCHOOL	
	NO.[1]	ENROLL[2]	NO.	ENROLL	NO.	ENROLL	NO.	ENROLL	NO.	ENROLL	NO.	ENROLL
0–250	17	537	237	6866	172	5118	409	11984	20	454	41	642
251–500	78	2685	755	22224	560	16561	1315	38785	140	2773	136	2269
501–1000	151	4955	1558	50137	1209	38916	2767	89053	506	12190	365	7731
1001–1500	32	1001	305	11323	221	7706	526	19029	340	9819	680	17494
Over 1500	8	246	169	6883	81	3165	250	10048	498	12542	1246	35305
Totals	286	9424	3024	97433	2243	71466	5267	168899	1624[3]	40803	2468	63441
							Grand Total		9645[3]		282567[3]	

[1] Number of teachers responding to questionnaire.

[2] Number of pupils enrolled in classrooms of responding teachers.

[3] Includes responses from 120 teachers with 3025 pupils in elementary grades 7–8 not otherwise totaled.

than seven years old at the time of the study and whose fixture : pupil ratios equalled or exceeded the standards of The National Council on Schoolhouse Construction.

The data were collected by observation of utilization of all plumbing fixtures in toilet rooms for each minute during a single day (April 10, 1957) within one high school (1,364 pupils), one junior high school (1,740 pupils) and three elementary schools (350, 376, and 837 pupils). The five schools had a total of 4,667 pupils. A time-use chart was made for each fixture and these were then summarized for each toilet room, indicating the actual simultaneous use at any time and showing the day-long pattern with times of maximum and minimum use.

Elementary School A

School A has two kindergartens and 12 classrooms. Each room has a sink and a fountain and the two kindergarten rooms have a self-contained toilet room with two toilets and a single lavatory. There were toilets adjacent to the multi-purpose room and to teachers' lounge. Pupils in grades 1–6 used two gang facilities centrally located to the classrooms.

The existing ratios were:

Boys—Toilets 1:52
Urinals 1:20
Lavatories 1:39

Girls—Toilets 1:25
Lavatories 1:37

Elementary School B

School B contains two kindergartens and 12 classrooms and is similar to School A.

The existing ratios were:

Boys—Toilets 1:49
Urinals 1:18
Lavatories 1:30

Girls—Toilets 1:17
Lavatories 1:26

Elementary School C

School C has two kindergarten rooms and 23 classrooms. Classrooms are equipped with sink and drinking fountain. The two kindergarten rooms share two toilet rooms each with one toilet and lavatory. There are toilets adjacent to the multi-purpose room and the teachers' lounge. Three separate pupil toilet rooms are available for each sex.

The existing ratios were:

Boys—Toilets 1:63
Urinals 1:29
Lavatories 1:42

Girls—Toilets 1:25
Lavatories 1:38

FINDINGS

ELEMENTARY SCHOOLS

It was found that a crucial factor in judging the adequacy of plumbing fixture installations in a school is the pattern of use and not only the fixture : pupil ratio. The pattern of use was found to depend directly on the school program. At the outset of recess, at class breaks, and during the lunch hour, particularly at the beginning and end, the toilet facilities maximum use was observed.

In the three elementary schools, even at peak usage, in the girls' toilet rooms, there was always one toilet unused. There was waiting observed in one toilet room, but this occurred when toilets in other rooms of the school were not in use. Adequacy also depends on location.

No waiting was observed in the boys' toilet rooms. Urinals were used four to five time more often than toilets. All of the boys' toilets were in use for at least one minute of the recess period.

Lavatory usage in both boys' and girls' toilet rooms varied directly with the use of toilets and urinals.

It was concluded that the number of toilets, urinals, and lavatories in the three elementary schools was adequate for the enrollment.

JUNIOR HIGH SCHOOL

The junior high school building contains 48 teacher stations and is organized on a semi-departmentalized basis. The building has a capacity of 1500–1600 students but enrollment amounted to 1,740 on the day of the time-use study. There are four toilet rooms for each sex.

The existing ratios were:

Boys—Toilets	1:87
Urinals	1:30
Lavatories	1:73
Girls—Toilets	1:41
Lavatories	1:73

FINDINGS

JUNIOR HIGH SCHOOL

The data reinforce the conclusion that programming has an important effect on toilet, urinal, and lavatory needs. Peak loads for both sexes occurred at the class breaks (every 50 minutes) and during the three lunch periods. In spite of heavy usage at regular times, toilet facilities were never taxed to capacity except in the gymnasium where the number of fixtures was about half that found in the other toilet rooms.

Except for the gymnasium area where there were only two toilets, at no time were all of the three toilets in the other three boys' toilet areas utilized simultaneously. At peak utilization of urinals the ratio of urinals in use to the number of boys enrolled was 1:54. At peak moments only about half the lavatories in the boys' rooms were in use.

The girls' toilets were utilized at highest rates during the five minute class breaks. There was some waiting in the toilet room of the physical education area. However, at peak utilization the ratios of toilets in use to girls enrolled was only 1:54. Peak utilization periods showed only half the lavatories in use.

The rates of utilization of toilets and urinals in this junior high school seemed low. It was felt by many that the presence of the observers and their charts inhibited usage. Such an inhibitary effect, if it exists, could probably be overcome by continued observation until pupils become used to procedure. The observer would probably, however, continue to inhibit use by those who come to smoke or avoid supervision.

The number of toilets, urinals, and lavatories in total were sufficient for the enrollment, but there was a shortage in the physical education sections.

SENIOR HIGH SCHOOL

The senior high school, first occupied in 1954–55 has a capacity of 2,000 but enrolled 1,364. However, two toilet rooms were closed off and are not included in the study. For the pupils in grades 9–11 (the building has not been in use long enough to enroll a twelfth grade) there are 60 pupil stations.

Existing ratios were:

Boys—Toilets	1:46
Urinals	1:46
Lavatories	1:53
Girls—Toilets	1:26
Lavatories	1:46

These fixtures were found in three toilet rooms for each sex. There is one large central toilet room for each sex in the general academic area, another pair in the cafeteria area, and a third pair in the physical education area.

FINDINGS

SENIOR HIGH SCHOOL

Patterns of heaviest utilization coincided with class breaks and lunch hours. Utilization of the toilet rooms in the cafeteria area was confined to the lunch periods. The four girls' toilets in this area were used to capacity during lunch hours, and for one period of 13 minutes there was waiting on the part of eight girls. There was a second waiting period of six minutes. Boys also had to waiting period of six minutes. Boys as well had to wait for toilets in the cafeteria area at the beginning of lunch periods. There was continuous use of urinals and lavatories by boys during the same time.

Peak use of toilet rooms in the physical education section occurred at the time of class breaks, but there was no evidence of overloading.

In the central academic area the girls' toilets were not used at capacity except for a ten minute period coinciding with the beginning of one lunch period and the ending of another. The lavatories were also all in use at this time. Congestion at the lavatories occurred and may have been due to the fact that the mirrors are located over the lavatories.

In the boys' toilet room in the central academic area facilities were ample, for there was no time when all toilets were in use.

On an all-school basis the number of fixtures was adequate to serve the enrollment, but inadequacies in distribution were noticeable. The conclusion that plumbing installation ratios must take into account the programming of the schoolday and the consequent peak loads was reinforced by the study in the senior high school.

With particular reference to the use of toilets in the schools visited, the Time-Use Study showed ratios for the elementary schools that ranged from 1:17 to 1:25 for the girls and from 1:49 to 1:63 for the boys. They were found satisfactory in all instances except for a short waiting period for the girls in Grant School during the peak loads.

The study showed a satisfactory ratio in the junior high school of 1:87 for toilets for boys, and 1:41 for girls, even though the principal was concerned that "the number of sanitary facilities is inadequate for current enrollment."

In the senior high school, there were ratios of 1:46 for boys' toilets, 1:26 for girls'. There was some waiting observed but two factors become clear. Some fixtures in the central toilet area could have been moved to the cafeteria area to eliminate the ordinary waiting periods there. Also, the toilet facilities in the cafeteria area were so located that only during each lunch period were they used; the rest of the day they were unused. It is suggested that better planning of school areas and attendant toilet areas could have better served the student body and with fewer facilities.

CODE ANALYSIS

Fifty-one building codes from twenty-seven states have been analyzed and summarized by the School Planning Laboratory in an attempt to assemble the latest data on this important element of school plant construction.

These analyses reveal a wide margin of variance in their minimum requirements. Ratio requirements for drinking fountains range from one unit per thirty pupils to one unit per two hundred-fifty pupils; the range for lavatories is one unit per twenty pupils to one per one hundred-fifteen pupils; for each toilet, one unit per fifteen pupils to one per one hundred pupils; and for each urinal, one unit per twenty pupils to one per one hundred.

This study of over fifty codes further reveals a conspicuous lack of concern in regard to the accessibility of the major plumbing facilities, a matter considered by educators to be of prime importance. Fewer than twenty-five per cent of the codes analyzed require that drinking fountains be provided on each floor and fewer than ten per cent recommend that drinking fountains be installed on playgrounds, in gymnasia, and in auditoria. Fewer than ten per cent require installation of toilets and urinals on each floor and only five per cent require such accessibility to lavatories.

There is evidence that slightly more attention has been directed to the sanitation aspect of the plumbing program. Almost fifty per cent of the codes require that major fixtures be constructed of vitreous china or other impervious material and prohibit installation of drinking fountains inside toilet rooms. More than thirty per cent require that drinking fountains be so constructed that the mouth cannot touch the nozzle and that the waste water cannot fall back onto the nozzle. Waterproof materials are often specified for toilet room floors and floor type urinals are frequently prohibited. Usually, the elongated, extended lip, and open front seat are required for toilet units.

The most frequently specified heights recommended for drinking fountains are 24", 28", 32", and 36" for primary, middle junior high, and senior high school grade levels, respectively. Requirements for toilet seat heights vary from 10"–15" for the primary and middle grade pupils with the 13" requirement predominating. For the junior and senior high schools the specifications are equally divided among 13", 14", and 15".

The initial fixture installation seldom meets the code requirement on the fixture-per-pupil ratio. For instance, a code categorized as requiring one toilet per each sixty pupils usually provides a graduated scale for the initial segment of enrollment, such as: a minimum of one fixture for the first fifteen, or fewer, pupils; a second fixture for the next twenty or fraction thereof; a total of three fixtures for any number between thirty-five and sixty; and one additional fixture per each sixty pupils thereafter.

The ratios in practice are consistently higher than those specified most frequently by the codes.

Summary of Findings by Fixture

All of the various sources of information gave a wide variety of information which, together with the analysis of educational program and conclusions as to the needed plumbing fixtures, serves as the basis of the recommendations. This information has been collated and is summarized below for each of the plumbing fixtures which can commonly be expected to be useful in a school.

For this report a standardized nomenclature has been adopted. The terms used have the following meanings:

Toilet room—a room having a toilet (water closet), a lavatory, and, in the boys' rooms, a urinal, or multiples of these fixtures.

Toilet—a water closet.

Lavatory—a wash basin, a hand washing sink, primarily for washing of the person.

Work sink--a sink for water, for washing objects, located primarily adjacent to educational project areas.

All other terms are self-explanatory.

TOILET ROOMS

GENERAL

There is a consensus that separate toilet rooms be provided boys and girls from kindergarten through grade twelve although some school systems provide but one room for kindergarten and sometimes first grade. Urinals were found to be desirable in even the kindergarten boys' toilet rooms for better sanitation and for training purposes.

If dual facilities are not provided for each kindergarten and first grade classroom, a single toilet room is desirable for each classroom to serve both sexes. The third alternative is that of having dual facilities shared by two adjacent rooms.

Above grade one, centrally located toilet rooms with gang installations are favored. Considerations of supervision, age differences, traffic flow, and time utilization suggest optimum ratios of one toilet room for each four to six classrooms from grade three to grade six, and one for each six to eight classrooms from grade seven to grade twelve. In schools covering different grades and maturity levels, it is desirable to provide separate facilities at least for kindergarten-primary, middle grades, junior high school, and senior high school.

Special requirements for toilet rooms have been found to exist in the following areas:

1. *Health suite.* A toilet room is necessary for the nurse and patients.
2. *Teachers' lounge.* Men's and women's toilet rooms are necessary, preferred with entrances from a corridor rather than from the lounge itself.
3. *Auditoria, gymnasia, music centers.* These areas require toilet rooms in the immediate vicinity for student use. If they are to be used for public performances or gatherings, it is necessary that toilet rooms be available to the public. It is common practice to utilize student facilities which are located conveniently, or to make public facilities available for student use during the regular instructional day. In any case, facilities must be adequate to care for the peak occupancy and must be located so the rest of the school plant does not have to be open to the public, in order to limit custodial service.
4. *Art, Industrial Arts.* These two areas and others, on occasion, are located on the perimeter of the school plant and require toilet rooms in the immediate area without regard to the number already provided elsewhere. The particular situation would indicate the need for toilet rooms for teachers and also for boys and/or girls.
5. *Physical Education.* Toilet room installations must be provided within the dressing-locker-shower areas in proportion to the peak occupants of these departments irrespective of other toilet room installations in the plant.

A toilet, lavatory, and shower have been found desirable in both the girls' and boys' physical education departments to serve the needs of their teachers.

Gang toilet rooms at best present difficult problems of maintenance and operations as well as supervision, and consequently should be designed with these problems in mind. The room should be well lighted, preferably with some direct sunlight, in order to encourage proper usage and to discourage loitering, smoking, and "art work." Likewise, it is easier to discover cleaning needs and consequently to keep the room shipshape, if lighting is adequate.

Ventilation should be accomplished by negative pressure rather than by forcing fresh air into the room, although exhaust fans may not be required. Temperatures need not be kept above 60° F., during the heating season.

The rooms must provide proper screening from the corridors, although it is not necessary that there be doors on the main toilet-lavatory entry; some systems have realized better supervision (and provided a degree of protection of pupils from being molested) by utilizing screen baffles rather than doors.

LOCATION AND SIZE

Toilet rooms should be no larger than necessary to accommodate the required fixtures and the anticipated traffic, in order to cut down loitering. A toilet stall, with doors, requires a space approximately 2½ feet wide, 4½ feet long, with 5 feet of passageway running along the row of stalls. Lavatories and wall hung urinals each require approximately 3 square feet of floor space. Lavatories or washfountains should be located near the exists while urinals should be nearer the door than the toilets.

Mirrors should be located near but not directly over lavatories in order to get fuller use of lavatories and to cut down on hair clogging of drains; on the junior high school and senior high school levels, a book shelf should be provided near the entry. There should be no drinking fountains in toilet rooms. A sanitary napkin dispenser and disposal should be provided in girls toilet rooms above sixth grade.

FLOORS, WALLS AND TOILET STALLS

The investigation of the advantages and disadvantages of specific materials which are used for floors, walls and toilet stalls was not a major purpose of this study. However, the following paragraph includes both solicited and unsolicited comments, observations, and opinions expressed by the interviewees and respondents to the questionnaires concerning materials. Satisfaction with any material would depend upon the additional information necessary for a thorough understanding of its relationships to other materials in terms of initial cost, maintenance costs, and the conditions under which it is to be used.

These surfaces should be of impervious materials which will not absorb odoriferous material. Ceramic tile, marble, quarry tile, terrazzo, hand plaster, metal, porcelain enamel, tempered glass, concrete plaster and transite, or combinations of these materials, were among the most common materials observed in the study.

Although costs of high quality material was often cited as the major reason for elimination of these materials from consideration, it was a common observance that these savings were soon lost in excessive maintenance costs as well as unsatisfactory performance that resulted in partial or total replacement.

Floors are generally of ceramic tile, quarry tile, or terrazzo, although sealing of cured grouting and of terrazzo is desirable. If concrete is used, it must be well sealed, and maintained in a sealed condition. Walls of tile (or other proven impervious materials) are most satisfactory. Hard plaster has been used for the complete wall surface and also for the wall surface above a wainscoting of tile with various degrees of satisfaction. Generally, the maintenance costs for plaster have soon exceeded any savings realized by the initial use of plaster rather than tile. Such materials as aggregate blocks are not satisfactory for toilet room walls, unless they are completely and competently sealed. Light, highly reflective colors only should be used in these rooms.

Toilet (and urinal, if such are provided) stalls should be of durable, impervious materials, possessing sufficient strength to resist the abuses of such nature as to be relatively easy to maintain and to clean, and at the same time to be of a light enough color to fit into the concept of a light, clean, room. There is no justification for the elimination or removal of toilet stalls in either boys' or girls' toilet rooms.

Newer methods of using traditional material are reducing overall installation costs. One example of these savings is the mesh type mounting of ceramic mosaic as well as glazed wall tile. These techniques are resulting in greater productivity of labor resulting in reduced costs.

There is probably no perfect toilet, wall or stall material, although marble has been standardized on in many systems, especially for toilet stalls, and would be used by others except for the high initial cost. *Flush metal* (enameled) stalls have a low initial cost, are light weight and sanitary when well cleaned and maintained. *Porcelain enameled* is easy to clean and maintain, is relatively light, and is sanitary. *Tempered glass* is impervious, sanitary, easy to clean. *Glazed or unglazed ceramic tile* can be made in designs desired locally, is sanitary if well maintained and cleaned, and is durable. Sealing of the grouting is required. *Concrete plaster* on a steel frame and with metal lath is durable and may be sanitary under careful sealing, cleaning, and maintenance; however, it requires frequent painting and sealing. *Waxed transite* or similar cement based panels are economical, relatively easy to clean, and strong; however, rusting of frames was reported in some instances where moisture was allowed to collect adjacent to the steel frame.

TOILET STALL DOORS

Many systems either do not provide doors on boys' toilet stalls, or remove them later because of breakage, difficulty of supervision, locking and crawling under, etc. A few systems do not provide doors on either girls' or boys' toilet stalls. Many systems do not provide doors on all boys' toilet stalls, but do provide some with doors for individuals who feel the need of privacy.

Door materials include: *wood*—easy to repair but requires considerable repair and maintenance; *plastic covered wood*—similar to certain desk tops, easy to clean, difficult to disfigure, but will scratch; *enameled metal*—has a low first cost, a short life, and scratches and rusts easily; *porcelain enameled steel*—has higher initial cost, but is easily cleaned and maintained.

TOILETS

BOWL

General. For proper sanitation and the avoidance of health hazards the toilet bowl must have a smooth impervious surface and contain no cracks or joints in which fecal matter may lodge. General simplicity of design is highly desirable. A safe water seal is necessary, and there must be a minimum of fouling surfaces of any type not covered by water which tend to become soiled. Other required qualities include: ease of cleaning, safety, economy of water consumption, positive flushing action, and a trap size equivalent to commercial standards.

Material. Vitreous china is accepted as the most desirable material for toilets.

Shape. The elongated, oval bowl is more sanitary than is the round which allows more urine to be spilled on the floor and seat than does the elongated. However, toilets for kindergarten through third grade are more generally of the round type.

Mount. From the standpoint of school operations, general sanitation and cleanliness, there is no doubt that the wall mounted toilet is to be preferred to the floor mounted. It is relatively easy to keep the floors clean, and free from trash. With a pipe or service chase, the wall mounted toilet is easy to maintain. However, a wet mop will not clear a 13″ wall hung fixture and therefore for toilets of this height a floor mounted bowl would be more satisfactory.

MOUNTING HEIGHTS

Physiologically, the squatting position is more efficient for evacuation and toilets should be mounted so that the user may use the facility in this position. Three sizes are commonly in use: 10″, 13″, and 15″.

Although 10″ toilets have been frequently installed in kindergarten and the lower grades, the study indicates a reluctance on the part of children to use them.

TOILET SEATS

Although the integral seat of vitreous china is easy to clean, it is not considered acceptable to users and most plumbing codes do not permit its use. Rather, a separate, hinged seat is preferred. There is almost total acceptance and demand for elongated, plastic or plastic covered, open front seats, less covers. Toilet seats for kindergarten through third grade of the round closed front type are commonly preferred. There appears to be no justification for the installation of germicidal lamps in conjunction with toilet seats.

HEALTH ASPECTS

The potential role of defective or outmoded toilet fixtures in the spread of intestinal-borne disease in the school has been described in medical literature. Few school authorities have given careful thought to the reasons why a toilet of one kind or location may be inferior to another. Proper location and sufficient quantity must be considered. From the medical and public health viewpoints is it desirable that the school supply safe, functional toilet fixtures and that they be maintained in a state of cleanliness and functional effectiveness. Administrative provision for the instruction of school custodians in the proper cleaning of plumbing fixtures, and especially of toilets and drinking fountains is highly desirable.

FLUSH VALVES

For the most part, syphon jet and blow-out toilets with flush valves are used. Flush valves are of either the piston or diaphragm type and either provides dependable operation.

Flush valves for toilets are operated in a number of ways, i.e., handle, push button, or pedal operated. Any of these are sometimes found with the flush valve concealed behind the wall. Where required, seat operated, flushing toilets were in use to eliminate the problems created by pupils who forget to flush them.

Flush valves equipped with a non-hold-open feature prevent waste of water and, when so specified, the valve will complete its flushing cycle and shut off automatically. With this type of valve there is no chance of accidentally or even maliciously propping the valve handle in open position to cause the water to run continuously. Flush valves correctly specified offer protection against vandalism, tampering, and back syphonage.

When fixtures are attached to the wall of an adjacent classroom or office, "quiet-acting" toilets with "quiet" flush valves are desirable.

Areas of low water pressure require special consideration.

Desirable Ratios:

	Elementary	Secondary
Boys:	max. 1:20 min. 1:40	max. 1:30 min. 1:50
Girls:	max. 1:15 min. 1:35	max. 1:20 min. 1:40

URINALS

GENERAL

As in the case with toilet bowls and other fixtures, it is universally accepted that urinals should be of smooth, impervious materials. Objectionable odors in toilet rooms often result from the absorption of urine in porous surfaces. The fixture, and the mounting, should minimize spillage of urine onto the floor or other surfaces, and should prevent splashing the user.

There should be a minimum of fouling surfaces all of which should be cleaned by the flushing action. There should be no concealed fouling surfaces, and the entire fixture should be readily cleaned. Outlets and traps must be of sufficient size to handle the volumes of water required for thorough flushing.

In the toilet room, the urinals are usually located nearer the floor than the toilet.

In many schools there is an installation of a urinal for boys in the lower elementary grades. Wall-hung fixtures are approximately 18" from floor level to the lip of the urinal. Urinals in the middle elementary grades are mounted 20" from lip to floor.

In both junior and senior high schools urinals are usually installed in, or in close proximity to, the following areas: Multi-use, auditorium, each six- to eight-classrooms, administrative area, physical education, music and/or little theater, industrial arts, and maintenance and operations area.

MATERIALS

One-piece vitreous china or duraclay are the most satisfactory fixture materials. There was little justification found for the installation of metal, tile, or slate urinals in a school, nor is there justification for continuous wall, or floor trough urinals.

MOUNTING

Although pedestal urinals are sometimes used in schools, there is little said in their favor for general boys' room installation. Actual practice is to provide either stall or wall-hung urinals. The stall urinal poses no height problems and presumably works as well for small boys as for big boys. However, they are less sanitary than the wall-hung models, tend to splash the user, and are more apt to serve as catch-alls for trash.

Wall mounted urinals must be mounted at the proper heights for their intended users. They should have an extended front lip to minimize floor soiling and splashing of shoes and clothing.

FLUSH VALVES

User operated flush valves, similar to those for toilets, are most often installed; however, boys apparently do not flush urinals after use as regularly as they flush toilets. Where this condition prevails, an active educational program, teaching the need for sanitation in the toilet room, has often gained the desired co-operation and result.

Hand operation can be entirely eliminated with the use of motor operated flush valves. These can be set to flush once every five minutes through heavy use periods and only once each hour through the night. Electric clock timers are available—or the school programming system can be used accurately to control these flushing cycles. Delayed door switches are also available which operate the flush valves only as the toilet room door is opened. However, electrically operated urinal valves are expensive and roughly can be from two to three times the cost of hand operated valves.

Foot operated flush valves are sometimes employed, but often these too are not operated with each use of the fixture.

Flush tanks are probably the cheapest to install, but since the operating cycle is continuous night and day, they waste large quantities of water. In any given situation, however, the cost of the water wasted should be weighed against the additional expense of installing the motor operated flush valve.

GIRLS' URINALS

Urinals for girls have only recently been installed and reaction to them is mixed. Instruction in their proper use has been found necessary. They are probably more sanitary, save some time, and require fewer fixtures. It may be that there would be greater acceptability were the fixtures manufactured in "juvenile-heights."

HEALTH ASPECTS

From the health viewpoint, urinals have no special hazards but they should be provided in sufficient numbers and in proper locations so that they are readily available and should be kept in a sanitary condition. There is some possibility that splash droplets may contain infectious organisms, but no medical research on this exists and little or no evidence is found in medical practice that the urinal is a health hazard. At least no medical reports of the spread of communicable disease among school children via the urinal are known.

Desirable Ratios:

	Elementary	Secondary
Boys:	max. 1:20 min. 1:30	max. 1:20 min. 1:30
Girls:	insufficient data	insufficient data

LAVATORIES

GENERAL

The term "lavatory" is used as a synonym for "wash basin" and "handwashing sink."

It is accepted that ample provision be made for all children to be able to wash their hands as needed, and especially after toileting and prior to eating. This implies operable controls, usable heights, the right numbers, and properly tempered water. Other common problems found for serious consideration are those of stream adjustment and control, construction of materials, and methods of mounting the fixtures.

LOCATION

Lavatories are commonly located in toilet rooms and should be installed near the entrance as an "invitation to wash up." They should be separated from toilets by a partition or screen. It is desirable that individual lavatories not be separated from other, like fixtures by stalls, partitions, or other screening devices.

Supplementary lavatories are required in the cafeteria or adjoining areas in sufficient quantities to accommodate pre-eating handwashing needs. Although handwashing facilities are often located within the lunchroom proper or in the corridors immediately adjacent, some systems have experienced satisfactory results from conveniently located gang installations. Some systems have experienced marked success with corridor installations, while other comment that such installations are a bottleneck. In any event, pre-eating handwashing is an integral part of both behavioral health and acceptable social conduct.

CONTROLS

Satisfactory controls require a minimum of maintenance and replacement. They must be made as vandal-proof as possible. Both the adjustment and the faucet handle (if a handle is used) should be keyed rather than simple screw controlled (Allen, Phillips, or similar screws, lock shield, or square shank). It is desirable to provide fixtures which will permit washing in running water, which do not require closing by hand after the hands are washed, and which do not waste water. This may be accomplished by the use of floor, foot operated valves which supply tempered water to a gooseneck spray.

Many school districts have provided foot controls in an attempt to meet these requirements, but one disadvantage is the high installation cost. Push-down timing devices are often provided, but they are sometimes difficult for small children to operate. Flush valves are occasionally used to provide a timed flow of water although installation costs are a factor. The non-automatic, turn-on-shut-off, faucet is used but the children often do not shut it off, and also must handle the controls after washing. The self-closing (spring tension) faucet is often favored by operations people but is not approved by either health people or teachers, since it does not permit washing in a steady stream of water. The kinds of controls installed in a school will represent a compromise of one or more of the four points, but any compromise should be within the framework of needs to be served rather than from a purely cost standpoint. If the controls which are installed are operable by the size child involved, the order of preference, from a purely functional standpoint, is the order in which they were discussed, viz., foot controlled, easily operated timing devices, standard shut-off, and self-closing but non-timing. Screens are recommended at the basin drain in lieu of waste plugs to permit washing in running water.

MATERIALS

Vitreous china and stainless steel are the easiest to clean, the most sanitary, and are generally considered the best materials for lavatories. However, initial cost, and breakage of vitreous china where vandalism is a problem are factors mentioned on the questionnaires and in the interviews.

Enameled cast iron basins are subject to surface cracking and breakage. However, because of great tensile strength, they have uses in shop and service areas where safety is a factor.

Steel enameled lavatories are acid resistant but generally have been found not to possess the ruggedness required for general school installations.

MOUNTS

Wall mounting is preferred since there is no floor obstruction, but to insure rigidity care must be taken that the unit is properly installed. Concealed chair-carrier mounts are the most satisfactory wall mount, since brackets, etc., present difficult cleaning spaces.

Pedestal mounts provide rigidity and firmness, but are difficult to clean and service. The trend is away from pedestal mounting.

Vanity and cabinet type mounts have no place in general toilet-room spaces in school plant construction because of high cost and cleaning difficulty. Such installations are often made, however, in the family living areas of homemaking suites and in teachers' lounges.

MOUNTING HEIGHTS

All school plumbing fixtures as any other equipment and furniture, must be the size that best serves the users. Lavatories should be installed so that the bottom of the basin can be touched from a standing position and with the arms extended at 45 degrees.

WATER TEMPERATURE

Some school systems provide only cold water. This practice is not recommended by authorities in the field. Tempered water (up to 115 degrees F.) is advised in all general use lavatories.

WASH FOUNTAINS

The wash fountain has wide usage particularly in industrial arts shops, corridor installations adjacent to the cafeteria, and in group toilet rooms. The basic design with foot control permits washing in running water, and, by the elimination of hand controls, results in better sanitation.

HEALTH ASPECTS

Good lavatories for use after children have been to the toilet are indispensable. Research and experience in medicine and surgery have long since proven the value of hand washing with soap and water in the prevention of intestinal and other diseases.

Lavatories located in close proximity to the toilets encourage post-toilet hand washing. Work sinks and lavatories that are installed at a height which permits the hands to be washed at a forty-five degree angle from the body are most conducive to comfortable use by pupils and such factors should be taken into account.

Desirable Ratios:

	Elementary	Secondary
Boys:	max. 1:25 min. 1:45	max. 1:30 min. 1:50
Girls:	max. 1:25 min. 1:45	max. 1:30 min. 1:50

WORK SINKS

GENERAL

Although there are a great many different kinds of specialized sinks required for certain specialized programs (from cosmetology to basketry), discussion here will be concerned only with the "usual" school practice. Formerly, work sinks were provided only in some of the special areas such as homemaking and science, but today they are being used in many of the regular classrooms.

Work sinks are desirable in all elementary school classrooms, core and special area classrooms at the junior high school level, and for special areas and many social studies and some language arts areas of the senior high school.

Classroom work sinks are used as a source of water, as a place to wash equipment and supplies, and for handwashing after painting or similar activities. It is desirable to have the area surrounding the sink covered with ceramic tile or laminated plastic with the same material for the splash board. The work sink should not, however, be considered as a substitute for the lavatory for either post-toileting or pre-eating handwashing. Tempered water is generally considered essential.

Work sinks need to be so designed and constructed that thorough cleaning is readily accomplished. Fittings of a readily cleanable type and material, and readily accessible to and operable by the users are considered essential.

MOUNTING

Most sinks are mounted on work and storage cabinets. Those used primarily for washing equipment often have an integral back, while those used as a source of water and also for washing purposes may be flush mounted to an impervious working surface. Handwashing sinks, however, are usually wall mounted, but for the purpose of this discussion are considered as lavatories rather than sinks.

MATERIALS

General use sinks for installation in regular classrooms, workrooms, and special areas other than science, with its special resistive requirements, are usually enameled cast iron, enameled steel, vitreous china, or stainless steel.

All types of plumbing fixtures, particularly sinks, depend in part on companion materials for complete sanitation. As many teachers have pointed out, both the aesthetic and practical qualities of the plumbing fixtures are enhanced by the installation of ceramic tile, laminated plastics, or other impervious materials. Two of the important contributing factors of companion materials, such as tile, are a choice of color with almost limitless design and long-term usage with low cost maintenance. Many tiles companies have worked out analogues, complimentary and neutral colors with plumbing manufacturers.

CUSTODIAL SINKS

Practice has been to provide custodial rooms with a service sink of enameled cast iron, vitreous china, or duraclay, protected by a rim guard and served with both hot and cold water. Such installations provide flexibility of use, but do not present the obvious disadvantage of requiring some lifting of mop buckets. The mop sink, with a lip not more than 10" to 12" above floor level, and hot and cold water (vacuum breaker protected) supply with hose bibb located in wall above sink at suitable height has been reported as desirable. Mop sinks may be porcelain enameled, terrazzo, tile, concrete, or similar materials. The disadvantage of mop sinks is the difficulty of gaining access to traps.

WORK SINKS IN SPECIAL AREAS

Art. For an all-purpose art laboratory, two peninsula or island work sinks are desirable in addition to a perimeter, double-compartment sink for soaking basketry materials. If water soluble paints, clays, and similar materials are used, it is desirable to provide special clay traps. Water flow to art room sinks must be sufficient to wash away sediment.

Homemaking. It is an accepted practice to provide a variety of equipment in the homemaking department in which case there would be both single and double compartment sinks, cabinets installed, and the most popular type being enameled cast iron.

A general purpose classroom sink is needed in the clothing area.

Industrial Arts. Handwashing facilities often take the form of wash sinks or wash fountains. Wash sinks are usually of porcelain enameled cast iron or vitreous china, wall mounted. Wall fountains are of precast stone, marble, or stainless steel. Hot (120 F.) and cold water are both needed, especially in any situation where the hands may become extremely soiled and greasy.

Music. The office or workroom requires a work sink as a source of water and as a place to wash small parts (and hands) during minor instrument repair. Both a high velocity jet and a standard faucet may be needed, depending upon the extent of repair work anticipated.

Science. In programs dealing with various caustics and acids, both sinks and work spaces must be acid-resistant, durable and long-lived, easily cleaned, and attractive. Soapstone, although it is hard, brittle, and costly, is widely used. Other materials which work well under careful use and proper maintenance include: Acid-resisting enameled cast iron and enameled steel, ceramic tile, asbestos-cement substances, sealed slate, stainless steel, and ceramic products.

The use of small amounts of dilute solutions of corrosive chemicals permits the use of extra heavy cast iron soil pipe for both waste and vents. The use of large amounts of concentrated chemicals requires the use of a high silicon content acid-resisting pipe. The initial cost of a high silicon content soil pipe must be considered, but, if concentrated acids are used, the cost would be more than offset by the necessary replacement of regular cast iron soil pipe.

These lines run independently to the main building drain where waste from other portions of the building will dilute them sufficiently to render them relatively harmless to the drainage system. Extra heavy welded lead or duriron traps are usually used for fixture connections on these installations.

Workrooms. Sinks are needed in all workrooms provided for clerical personnel and teachers, also in business education, journalism, and library areas. In order to simplify maintenance, it is desirable to standardize this equipment by installing the same kinds of sinks in both the workrooms and classrooms. These should provide both tempered and cold water. In a duplication space, if water soluble inks are used on stencils which are washed, a regular service sink is of more value than a countertop work sink.

DRINKING FOUNTAINS

GENERAL

There is a sound physiological basis for the provision of drinking fountains in schools. It is important that children drink an adequate supply of water for the maintenance of body fluids and electrolyte balance, as well as for the prevention of constipation and alleviation of thirst. There is also an obligation on the part of the school authorities to provide water without the hazards of transmission of saliva-borne diseases. The drinking fountain should be so designed that the mouth cannot touch the water outlet and that water, after touching the lips of a user, cannot fall back on the orifice or become mixed with drinking water. Cross-connection and back-siphons must be prevented.

Present hard surface materials used for drinking fountains contribute to accidents, particularly at the nozzle and the nozzle cover, involving the teeth, lips and face. Uncovered outdoor drinking fountains collect dust and their use by animals and birds is often observed.

In the interests of convenience, supervision, and efficient time use, drinking fountains are desired by teachers and principals in classrooms from kindergarten through grade six. They should be in the main classroom, not in the toilet room, and located away from doors and other traffic lanes. For both sanitation and safety, drinking fountains should not be attached to or be an integral part of the work sink. They should be installed with water pressure regulators and guards to minimize squirting of water.

Drinking fountains are not requested for junior and senior high classrooms although improved design may make them desirable in junior high core curriculum programs. Fountains for these grade levels should be in the corridors, recessed, and away from stairs and corners. Numbers should be sufficient to satisfy the peak needs which can be determined only by an examination of the local school program.

It is generally requested that drinking fountains be provided for those school areas which are near the plant perimeter and thus not convenient to drinking fountains, for those areas where the nature of the activities promotes water consumption, and for those areas which serve people gathered for spectator and participatory activities. Among these areas may be included oral arts, music, homemaking, industrial arts, library, auditoria and multi-use rooms, cafeteria, physical education, and gymnasia.

MOUNTS

Pedestal fountains are often used for playground installations but are not readily adaptable for interior use.

Wall mounted single, two, three, etc.—place installations are most generally acceptable for interior corridor, multi-use, foyer, and separate classroom usage. The mounting heights can be adjusted to the needs of the users.

Water chillers and coolers are often used in areas of extreme heat. Some schools provide a central chiller (pipe-chase or closet location) which serves "regular" wall mounted drinking fountains.

MOUNTING HEIGHTS (TO NOZZLE TOP)

Practice indicates desirable mounting heights at 24" for kindergarten to grade 3, 28" for grades 4 to 6, and 34" from grades seven to twelve.

Desirable Ratios:

Pupils	Elementary	Secondary
(Boys & girls)	max. 1:30 min. 1:45	max. 1:40 min. 1:65

SHOWERS

GENERAL

It was found that primarily, school shower installations are made to serve physical education programs, although in some schools, elementary as well as secondary, installations are made to serve students from low socio-economic areas who have no bathing facilities at home. The basic purpose in either situation is personal washing. The total installation must be such as to encourage student usage. This implies general cleanliness of the shower room, adequate space for traffic in and out, some provision for individual control of both temperature and flow and an adequate flow of water. "Rain rooms" and "progressive lanes" are generally disliked by both boys and girls for ordinary showering purposes, although shower lanes fill a need in conjunction with swimming pools.

Showers are generally provided for grades 7–9 when such grades are a part of a junior high school, or when grades 7–8 are organized as a separate school. However, when the seventh and eighth grades are a part of the K–8 or 1–8 school these facilities are often not provided, although physical education teachers consider showering essential following the kinds of activities engaged in by this age group in their classes.

Showers are considered standard equipment for senior high schools sponsoring physical education programs or athletic teams. Boys' showers are universally of the group type.

The use of group showers for girls is gaining more acceptance, although most schools providing them also provide a limited number of individual shower stalls or a modified partition type with a central drain. In Los Angeles the use of the term "group showers" instead of "gang showers" has helped to remove resistance by boys as well as girls to the open shower room.

CONTROLS

Every school shower installation requires positive temperature control protection. Tempered water, only, should be admitted to the hot water lines at a generally accepted maximum temperature of 120 F., and some districts limit the maximum to 105 F. Master temperature controls require security against tampering.

The four types of shower controls in use are as follows:

A. Separate hot and cold water controls provided at each shower head. With this method a master thermostatic control is used to provide safe hot water, not over 120 F.

B. A single mixing valve at each shower head. The safest and most efficient of this type are thermostatic with a volume regulator built in.

C. A master thermostatic control (panel or cabinet) mixing both the hot and cold water and operated by a shower room attendant.

D. Flush valve operated showers supplied with pretempered water. The flush valves are set to run for 15 to 20 seconds and then shut off. These save water during the shower as well as prevent the shower being left on.

Control valves for both junior and senior high schools are appropriately located at about 45″ above floor level.

SHOWER ROOM DRAINS

From the standpoint of health, it is essential that the drains be so located that the soiled water from one bather does not flow into an area occupied by another bather, although this is primarily an engineering and architectural problem rather than a fixture problem. From a safety standpoint, curbs should be limited, and no-slip floors installed. Perimeter gutters help keep water off the center floor. Although they are subject to damming, this can be controlled by the use of domed screens.

SHOWER HEADS

The most desired shower heads are self-cleaning, vandal-resistant, and adjustable. Automatically self-cleaning shower heads are now being specified to eliminate maintenance costs and provide a better shower spray. The use of flow regulators on each shower head spreads the load evenly and reduces water consumption. For the most part, maintenance and operations people desire shower heads which are vandal-resistant, and self-cleaning, while school personnel who work with students are concerned with adjustable heads. These general requirements are reflected in practice, in that those who place the highest priority on vandal-resistance tend to specify some sort of fixed, institutional or prison-type head, despite the fact that it provides no adjustment and is difficult to remove for cleaning. Heads are available which incorporate all three characteristics. A properly designed spray pattern overcomes the necesssity of adjustable heads.

It is desirable that shower rooms having heads on opposite walls be at least 10 wide.

MOUNTING HEIGHTS

It has been found that both boys and girls take showers more willingly if the shower heads are mounted so that it is possible to shower without getting the hair wet. Generally, the shower heads should be mounted so that the stream hits at about shoulder height. Mounting heights may be slightly greater if the stream may be angled so that it is at shoulder height a few feet away. However, dependance on moving away from high mounted heads to adjust stream height is more demanding of shower room space.

Aside from "rain rooms," actual mounting heights for shower heads vary in general practice from 5′0″ to 6′0″ for boys, and for girls from 4′6″ to 5′6″.

It is fairly common practice to mount shower heads at different heights within a single gang shower room, in order to accommodate both shorter and taller students. Actual measurement of youngsters in specific communities may indicate slightly different desirable mounting heights; the important point is that shoulder height, plus about two inches, appears to be the most satisfactory height from the floor to the bottom of the shower head. A more recent approach to adjustable heads and different mounting heights is the development of shower heads with a proper pattern which spray the water in a pre-determined pattern with a minimum of splashing and make adjustable heads and mounting height of less concern.

RATIOS

It is the consensus that the number of shower heads required in any physical education installation is based on the kind of educational program to be served (showering after an archery session may not be as essential as showering after gymnastics or soccer), the numbers of students in peak classes who will be expected to shower, and the amount of time allocated for showering and dressing prior to next classes. In situations where showering-dressing time is limited, one shower for each three users seems to be reasonable although lesser ratios are sometimes found (1:4, 1:5, 1:6). The lesser ratios usually result in waiting and improper showering for some users.

NEED FOR REHABILITATION OF EXISTING SCHOOL PLANTS

Over the years great changes and improvements have been brought about in all areas, including school buildings. Since World War I the trend has been toward the elimination of basements and belfries, cutting down on the non-functional areas, and spending more time planning from within.

The end results have been encouraging and today we have modern functional school plants that are the result of architectural interpretations of the educational needs of the school districts that are providing housing needs for their children and youth.

In the process of collecting data for this study it became apparent that in the area of school plumbing fixtures the good old days, after all, were not as good as we sometimes nostalgically recall. In addition it is evident from the comments made in questionnaire responses that much rehabilitation is needed throughout the country in the area of plumbing fixtures.

Fifty-nine per cent of the questionnaires answered by teachers indicated a need for additional fixtures, or stated that those in use were mechanically imperfect, or obsolete and should be replaced with modern equipment. In many cases, by balancing out the system, more fixtures could have been installed using the same water supply piping.

"Toilet facilities in the teachers' rooms should be increased, also modernized so that we don't get a shower bath every time we enter the room."

"I think decent facilities should be provided for the faculty. There are two toilets for 58 women teachers."

"Additional showers that will work are needed."

Although only a few statements have been picked at random from the questionnaires, they are indicative of the type of comment that was commonly made by teachers who were working in older buildings.

These comments were fairly evenly distributed throughout elementary, junior high, and senior high schools.

Some typical statements taken from the questionnaires are listed below:

"We need more modern plumbing fixtures in the boys' toilets."

"The plumbing fixtures in the teachers' room need to be replaced."

"Water runs in some of the toilets almost constantly."

"Modern toilets that will readily flush and do not drip water from overhead box."

"More modern controls at basin."

These comments were not solicited, which shows even more that these unsatisfactory conditions are a deterent to the efficiency and wellbeing of the faculty members and have an impact on the health and educational progress of the children.

The comments are not limited to toilets but also include work basins, work sinks, urinals, showers, drinking fountains, and other fixtures.

Much concern was also evidenced as to the location of all installations. This causes the survey staff to be concerned about replacing these units before a thorough study of the functional aspects have been made.

The evidence is very strong that in many older school buildings obsolete and malfunctioning plumbing fixtures are a definite handicap to a good educational program.

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III

Recommendations

GENERAL

This study has been made to determine the kinds, numbers, sizes and locations of the plumbing fixtures required to meet the needs of children in a modern program of education. It is based on the premise that the only justification for the installation of plumbing fixtures in school buildings lies in their contribution to the education, health, and welfare of children. The data which have been presented and the conclusions and recommendations which follow should be of utility to educational and architectural planners, and to plumbing fixture manufacturers and installers, as well as those engaged in related industries.

The data have been gathered from a wide variety of sources by a variety of methods, over an eighteen month period. Questionnaires and interviews have been used, building and plumbing codes analyzed, and a time-use study made. Just as important has been an analysis of educational programs to determine plumbing fixtures needs. The conclusions thus depend on the facts gathered and on the knowledge and opinions not only of the staff of the School Planning Laboratory and other members of the Faculty of the School of Education, Stanford University, but also on the knowledge and opinions of thousands of school personnel, and of architects, planners, and consultants.

One other source of data on which recommendations have been based has not been previously mentioned. This is the handbook, ***Basic Body Measurement of School Age Children***, prepared by W. Edgar Martin and issued by the U.S. Department of Health, Education and Welfare, Office of Education. These basic data have been used to supplement the calculations made on many of the dimensions recommended in this report. Other source material consulted in the study is listed in the bibliography.

By a process of synthesis and analysis the survey staff has arrived at a series of conclusions regarding answers to the questions originally posed. These conclusions, stated as recommendations are presented here. The recommendations, in the opinion of the survey staff, should, if followed, result in a satisfactory working situation educationally.

One fixture : pupil ratio cannot be recommended for any one fixture, either for boys or girls. This is true at both the elementary and secondary levels. The data is very conflicting when existing, desirable, and code ratios for the same type fixtures are examined at the same grade levels. The factors which are basic to the conflicts are: location of the facilities in the buildings, ease or difficulty of supervision, and the school program. Consequently, it may be possible to justify a ratio of 1:20 for girls' toilets and one of 1:30 for boys' toilets in three story buildings where all the toilets are in the basement and where the program makes it necessary for all of the pupils to make use of the toilet facilities at the same time.

The fixture : pupil ratios are designed to care for the peak loads. Any change in location or in program that permits a lessening of the peak loads will result in fewer fixtures per pupil being necessary.

The fixture : pupil ratios recommended in the following text are mean ratios derived from the maximum ratios that could be necessary in the most unsatisfactory schoolhouse environment and the minimum ratios that would be possible with optimum educational facilities. These maximum and minimum fixture : pupil ratios have been noted in Section II, Findings, under each fixture discussed. In each case, the provisions for initial segment enrollments, included at the end of the section, should be considered the base upon which the appropriate ratio is applied. Additional information pertaining to the determination of the desirable ratios is given in Section II under the titles: "Questionnaire to Teachers," "The Time-Use Study," and "Code Analysis."

TOILET ROOMS

GENERAL

Separate facilities should be provided for boys and for girls in the kindergarten and grades one through twelve.

Separate facilities should be provided for the kindergarten and primary grades, as well as for the middle, junior high, and senior high school grades.

Centrally located gang or group installations should be provided for grades above grade one.

Kindergarten and grade one (K–1) should have toilet rooms within the self-contained classrooms.

Grades two to six (2–6) should have one boys' toilet room and one girls' toilet room for each four to six classrooms.

Grades seven to twelve (7–12) should have one boys' toilet room and one girls' toilet room for each six to eight classrooms.

Separate facilities should be located in the:

Health Suite

Auditoria, gymnasia, and music centers

Art and Industrial Arts areas

Physical Education area

Teachers' Lounge—separate facilities for men and women—adjacent to but not opening on lounge.

Special

Well lighted.

Proper screening from the corridors.

Mirrors located near but not directly over lavatories.

Sanitary napkin dispenser and disposal in girls' toilet rooms above the sixth grade.

Walls and floors of impervious materials; light, highly reflective colors.

Doors on some stalls.

Doors of baked enameled steel or equivalent.

Book racks in high schools.

TOILETS

Bowls

Smooth impervious glazed surface without cracks or joints.

Safe water seal.

Vitreous china, acid proof finish.

Round shaped for grades K–3.

Elongated oval bowl for grades above the third grade.

Positive flushing action.

Siphon-jet and blow-out toilets with flush valves.

Trap size equivalent to commercial standards.

Quiet type fixtures for rooms adjacent to principal's office, teachers' room, or classroom.

Seats

Separate, hinged seat.

Plastic, or plastic covered, elongated open front seats, less covers, for grades above the third grade.

Plastic, or plastic covered, round closed front type, less covers, for grades K–3. Open-front seats are available when desired.

Flush Valves

Non-hold-open flush valves of either the piston or diaphragm type.

"Quiet" flush valves and bowls especially when the wall to which the fixtures are attached is adjacent to a classroom, teachers' room, or office.

Concealed flush valves or if the exposed type, appropriately designed to be vandal-resistant.

Special Requirements

For specific operations requiring minimum water consumption pressure tank installations are often desirable.

Health Aspects

Number and location of fixtures determined in light of the size and distribution of the population served.

Mounts

Floor mounted, 13" bowls for grades K–3.

Wall mounted, 15" bowls for grades 4–12.

Although 10" bowls are probably somewhat better physiologically for five and six-year-olds, pupil and parent opposition is such as to outweigh this advantage.

Toilet-Fixture-Student Ratios

Elementary boys (K–6)	1:30
Elementary girls (K–6)	1:25
Junior and Senior High boys (7–12)	1:40
Junior and Senior High girls (7–12)	1:30

The provision of two toilet rooms for each kindergarten and first grade classroom results in higher ratios in the elementary grades.

URINALS

General

Urinals in boys' rooms from kindergarten through grade twelve.

Urinals nearer door than the toilets in toilet room.

Smooth impervious material.

Minimum fouling surfaces.

Vitreous china, acid proof finish.

Wall-hung with extended lip.

Motor operated flush valves or equal. To avoid vandalism these should be either concealed or mounted high above the fixture.

In any situation where water supply is not a serious problem, urinal tanks may be the most economical installation. Girls' urinals gaining acceptance (insufficient data for recommendations.)

Mounting Heights

Maximum recommended from lip to floor:

Primary grades (K–3)	18"
Middle grades (4–6)	20"
Junior High School grades (7–9)	22"
Senior High School grades (10–12)	24"

Urinal-Fixture-Student Ratios

Elementary boys (K–6)	1:25
Junior and Senior High boys (7–12)	1:25

WORK SINKS

General

Provide: In all elementary school classrooms.

In core and special area classrooms in the Junior High School grades (listed below).

In special areas and some Social Studies and Language Arts areas of the Senior High School.

Special

ART

Perimeter, double-compartment sink.
Two peninsula or island sinks.
Special clay traps—plaster interceptor.
Water mixing supply fixture.

HOMEMAKING

Single- and double-compartment sinks.
Cabinet installed.
Classroom sink in clothing area.
Water making supply fixture.

INDUSTRIAL ARTS

Porcelain enameled cast iron (A.R.) vitreous china, precast stone or marble, stainless steel, or porcelain enameled steel.

Hot (120 degree) and cold water—thermostatic.

MUSIC

High velocity jet and standard faucet on work sink for washing musical instruments.

SCIENCE

Work spaces and sinks acid-resistant (A.R.) and durable traps, drains, and vents (impervious and A.R.) extend from sink to waste line.

WORKROOMS

Provide for nonclassified personnel and teachers.

Provide facilities for Business Education, Journalism, and Library areas.

Water Temperature

Tempered water (up to 115 degrees) recommended for all general use work sinks.

Water mixing supply fixture.

Mounting Heights

From rim to floor:*

Kindergarten (if used by children)	24″
Primary grades (1–3)	27″
Middle grades (4–6)	27″
Junior High School grades (7–9)	31″
Senior High School grades (10–12)	31″

* These heights are based on an eight inch depth in the bowl. Children in the various age groups should be able, with these mounting heights, to reach and work at the bottom of the bowl with arms at a comfortable 45 degree angle.

DRINKING FOUNTAINS

General

Need for better sanitation and safety design.

Not to be a part of work or wash sink—separate fixture.

In classrooms, kindergarten through grade three, away from doors and other traffic lanes.

From junior and senior high, in corridors, recessed, away from stairs and corners.

Need for constant pressure at fixture.

In numbers to meet peak needs.

In areas near plant perimeter.

In areas of strenuous activities.

In areas of student and public gatherings.

Vandal proof fittings.

Water chillers and coolers in areas of extreme heat.

Freeze-proof mechanical parts in areas where freezing is a problem.

Mounting Heights

Maximum recommended to nozzle top:

Primary grades (K–3)	24″
Middle grades (4–6)	28″
Junior High School grades (7–9)	34″
Senior High School grades (10–12)	34″

Fixture-Student Ratios

Elementary (K–6)	1:40
Secondary (7–12)	1:50

In general, a minimum of two drinking fountains per floor is recommended.

SHOWERS

Grades K–6

Provide in elementary schools for students having no or inadequate home bathing facilities.

Grades 7–12

Gang installations for boys.

Combined gang and individually partitioned installations for girls.

Mixing valves or equivalent operation—thermostatic.

Control valves 45″ above floor level.

Safety Features

Limited curbs.

Non-slip floors.

Positive water temperature control protection—thermostatic.

Shower Heads

Self cleaning, vandal resistant, and with a properly designed spray pattern to overcome the necessity for adjustable heads. Institutional types offer best protection against vandalism.

Mounting Heights

Junior High School grades, boys	56″
Junior High School grades, girls	54″
Senior High School grades, boys	60″
Senior High School grades, girls	56″

Fixture-Student Ratios

In physical education installations	1:3

In other areas as needed.

LAVATORIES AND WASH FOUNTAINS

General

Facilities in or near cafeteria.

In toilet rooms near entrance.

In shops and crafts rooms.

In Journalism and Special Areas of Business Education.

Designed so that hands are washed in running water; open waste strainer.

Porcelain enameled cast iron, enameled steel, or stainless steel, precast stone or marble where great tensile strength is required (shop areas and service areas).

Controls

In order of preference:

1. Foot controls.
2. Easily operated timing devices.
3. Standard shut-off.
4. Self-closing but non-timing.

Water Temperature

Tempered water—thermostatic (up to 115 degrees F.) at all general use lavatories.

Mounts

Concealed chair-carrier.

Concealed wall hung.

Vanity and cabinet type in family and homemaking areas.

Mounting Heights

From rim to floor:*

Kindergarten and grade one (1)	24″
Grades two and three (2 and 3)	27″
Middle grades (4–6)	27″
Junior High School grades (7–9)	31″
Senior High School grades (10–12)	31″

* These heights are based on a basin depth of six inches and should make it possible for pupils to reach the bottom of the bowl with arms at a comfortable 45 degree angle.

Fixture-Student Ratios

Elementary boys (K–6)	1:35
Elementary girls (K–6)	1:35
Junior and Senior High boys (7–12)	1:40
Junior and Senior High girls (7–12)	1:40

PROVISIONS FOR INITIAL SEGMENT ENROLLMENTS

		Toilets	Urinals	Lavatories	Drinking Fountains
15 or fewer	Boys	1	1	1	1
	Girls	2	–	1	–
16–35	Boys	2	2	2	2
	Girls	3	–	2	–

ADDITIONAL CONSIDERATIONS

1. The water provided for school use should be analyzed to determine its need for treatment in combating the maintenance problems which may be expected from an untreated supply, i.e., staining of lavatories due to iron or turbidity in the water and lime scale formation which clogs pipes and causes malfunctions of the valve operating equipment.

2. Conservation of water is of increasing importance in most school areas. Methods of controlling the flow of water and also the water pressure should be investigated to determine their effectiveness in conserving water while maintaining the efficiency of the fixtures.

Thermostatic controls contribute to water conservation and the efficiency of the fixture but involve consideration of a minimum water pressure as well as the water temperatures.

Water pressure at drinking fountains is a common problem which needs consideration. The pressure here often varies with the frequency of use of the other plumbing fixtures and makes the drinking fountains inoperable, generally when they would be most used.

3. Although drainage and vent piping has not been generally included in computing the number and placement of plumbing fixtures, it does assume considerable importance in the maintenance program during the life of a building. The drainage and vent piping in a building and in the ground under the building is inaccessible except at great expense and so must be of the best quality to reduce major repairs to a minimum. Cast iron soil pipe will meet the requirements of all local plumbing and building codes and is generally considered the best drainage and vent pipe material for the life-time requirements. All soil pipe and fittings should bear the (C) C-1 mark of quality or their approved equal by the specifying authority.

GENERAL COMMENTS AND SUGGESTIONS ON LOCATION AND DESIGN OF FACILITIES

1. The present trend is for more joint purchase, use, and maintenance of facilities by school and community. The trend requires master planning for location and number of all plumbing facilities.

2. Overloading of design capacities which occur during breaks in public and scheduled school gatherings such as meetings, spectator sports, etc., indicate that more attention must be given to minimal design requirements to accommodate this type of use. The important consideration is that there be sufficient numbers of the right kind of installations to accommodate the numbers and kinds of users anticipated. If an auditorium or gymnasium is to be used for night activities, it is desirable that there be sufficient toilet-room and drinking facilities within the space so other components of the school plant will not need to be opened to obtain access to toilet rooms.

3. School building design has gone through the following stages: the two and three story school, the one story finger-type plan, the block or loft type school, and, finally, a more concentrated emphasis on campus type plan. It is apparent that placement of toilet room facilities has not kept pace with school design trends. The number of fixtures per pupil within the entire school was found to be adequate in many cases, but more attention is needed in the proper placement of fixtures according to the areas where they will be used.

4. A need is indicated for more open work areas that allow for maximum supervision. Suggestions offered vary from open areas to glassed-in spaces with direct access to toilet areas.

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